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ABSTRACT

A survey of 28 military industrial, government, and academic learning centers was conducted. The purposes were to document the state of the art in the establishment and operation of these centers and to determine their potential usefulness in terms of being able to provide individualized, cost-effective instruction in Air Force training programs. The survey identified each center's goals, instructional techniques, and learning resources; attention was also paid to instructional development procedures, courseware production and maintenance philosophy. Student time savings, increased learning and cost-effectiveness were generally reported, although specific cost data were hard to retrieve. The learning centers deemed most effective were those which: 1) were designed to meet clearly defined, existing instructional needs; 2) specified student performance requirements; 3) were administered under a unified system which controlled the quality of courseware content and production; and 4) developed and produced their own courseware to meet specific needs. (Author/PB)

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A SURVEY OF THE PRESENT STATE-OF-THE-ART IN LEARNING CENTER OPERATIONS

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February 1974

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This report summarizes a survey of selected military, industrial, government, and academic learning centers. Documentation of 28 learning center programs is recorded and illustrated. This documentation includes primary characteristics and a description of operational procedures and experience at the learning centers. Learning centers deemed effective were (1) designed to meet a clearly defined and existing instructional need (and typically included student performance requirements), (2) administered under a unified control of courseware

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content and production quality, and (3) largely developed and produced their own courseware to meet their specific needs. In general, student time savings and increased training effectiveness were reported. Learning centers can provide cost-effective instruction.

SUMMARY

Problem

Learning centers have been recommended to provide Air Force training with individualization of instruction and an improved cost-effectiveness of instruction. The problem was to determine and document the current state-of-the-art in the establishment and operation of learning centers.

Approach

A survey of selected military, industrial, government, and academic learning centers was performed. This included site visits to 37 representative learning centers, supplementing an analytic questionnaire with photo documentation.

Results

Documentation of 28 learning center programs at 24 sites is recorded and illustrated. This documentation includes primary characteristics and a description of operational procedures and experience at the learning centers.

Conclusions

Student time savings and increased training effectiveness were generally reported. Learning centers can provide a cost-effective approach to instruction. This conclusion is based on very little actual data, since usable documentation of costs is not generally available. Most people either do not or are unwilling to find out what the costs really are.

Three characteristics were associated with the learning centers which appeared to be most effective. The learning center was designed to meet a clearly defined and clearly existing instructional need (and typically included student performance requirements). The learning center was administered under a unified control of the courseware content and production quality. The development and production of the courseware designed to meet specific learning center needs was largely within the organization.

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I. INTRODUCTION

The relationship between training effectiveness and the accomplishment of the Air Force's mission has become increasingly apparent in the face of changing national priorities, mission, and force structures. These changes result in increasing demands for more effective training within the military context. These demands necessitate that Air Force training produce better trained individuals either in less time or at less cost than is presently being done.

In order to meet these requirements, interest within the Air Force has focused on the concept of individualized instruction and continuation training. The authors have been tasked to examine the state-of-the-art in one aspect of individualized instruction - the concept and implementation of learning centers. This report represents the first phase of that examination.

Purpose of Study

The purpose of this study was to establish the current state-of-the-art in the establishment and operation of learning centers. The specific task was to accomplish the following:

1. Select a sample of learning centers representative of the state-of-the-art within the military, academic, commercial, industrial, and non-military governmental communities.

2. Survey the selected centers to determine the need for establishment of the center, student population characteristics, areas of instruction, methodology of software development or acquisition, hardware selection and utilization, operational procedures, and any other information pertinent to the establishment, operation, and administration of learning centers. This data then was to be compiled into a publication describing and categorizing the learning centers surveyed. This report represents the results of this phase of the study.

Approach

In establishing the rationale for the survey of learning centers, it was apparent that this study would be dealing with a small, but rapidly expanding population of training establishments. It was recognized that while the existing population of learning centers would be somewhat small, it would still be too large to allow an all-inclusive survey. Thus, some form of sampling rationale would have to be applied in order to select a manageable, yet representative, sample.

The sample of learning centers included in this study was selected in the following manner:

1. A working definition of the term "learning center" was established and was used in the following steps.

2. The literature dealing with education, training, architecture, human factors and the research in these broad fields was examined for indications of learning center operation and/or research in the areas of learning center design and operation.

3. Knowledgeable individuals within the military, industrial, commercial, and academic communities were contacted to help identify instructional situations which might be considered learning centers for the purposes of this study and to clarify information obtained from other sources.

Literature Search. In order to identify instructional situations which qualified as constituting a learning center, a search and analysis of the trade and research literature was conducted in the field of education, training, architecture, and human factors. The result of these literature searches produced identification of centers previously unknown to the authors. More importantly, the results provided a data base from which information necessary for the successful completion of Phase II could be extracted.

Professional Support. It was assumed that innovative instructional situations would be recognized by the instructional community in which they occurred. In order to overcome the lag inherent in the publication cycle common to almost all disciplines, contact was established with individuals and organizations whose responsibilities include a working knowledge of the status of instructional innovations. These contacts were used to identify additional learning centers to be included in the study sample and also to verify data acquired from other sources.

Contact was established with cognizant organizations within each military service, the US Office of Education, the California State Board of Education, and the Association for Educational Communications and Technology (AECT). These contacts were extremely helpful and productive as sources of information on the existence, status, and characteristics of learning centers.

II. SURVEY METHODOLOGY

The specific purpose of Phase I was to collect a comprehensive body of data on the design, operation, and administration of learning centers. Data acquisition was accomplished during a series of visits to the learning centers listed in Survey Data. During these visits answers to the following questions were sought.

1. What are the instructional tasks of the center?

2. Why was the learning center program adopted?

3. What are constraining factors within which the center operates (e.g. subject matter, time, costs, facilities, student attributes, etc)?

4. How effective has the learning center been?

5. How are the instructional materials (courseware) developed to support the learning center?

6. What costs are incurred in the development, implementation, and operation of the learning center?

The survey visits were completed over a two month period (October to November 1972) using the survey instrument included in the appendix. The results of this effort are summarized in Summary and Conclusions. The results of each visit including photographs of the salient features of each center are contained in Survey Data of this report.

III. SUMMARY AND CONCLUSIONS

The results of the site visits can be summarized in several ways. We have chosen to summarize the results of our survey visits in terms of the following questions;

1. What is a learning center?
2. Do learning centers work?
3. Why a learning center?
4. How does a learning center function?

What is a Learning Center?

A learning center is primarily an instructional system. It is "a set of interrelated, interacting, precisely controlled learning experiences that are designed to achieve a specific set of training objectives, but organized into a unified, dynamic whole which is responsive and adaptive to the individual student while fulfilling specific job-relevant training criteria" (AFM 50-2, Instructional System Development, Washington, D.C.: Department of the Air Force, December 1970).

A learning center differs from the common conceptualization of an instructional system in that it counts facilities, personnel, and production capabilities as more important characteristics than do other expressions of the instructional systems concept. In a learning center the management/organizational structure within the center and within which the center functions becomes much more important than in less structured instructional concepts.

A learning center is a program or environment in which instructional technology (including the ISD process) is specifically directed at the instruction of individuals or small teams. While the most visible aspects of a learning center are generally the devices and carrels, the software development aspects are of equal importance. Software is virtually always locally or specifically prepared. It includes a learner-centered environment with emphasis on both self-pacing and self-selection among alternate instructional packages and alternate presentations of the package. These presentations may vary in terms of media, difficulty, or intention (i.e. overview, instruction, review, etc.). Often the program is conducted in a series of learning stations or carrels in which automated presentations include provisions for visual presentation of what to do, a verbal presentation (written or auditory) of how to do it, with provisions for actual task performance. Considerable emphasis is placed on instructional strategies with frequent elicitation of specific responses and confirmation of the appropriateness of the response. To the fullest extent possible, the confirmation is indigenous within the behavior in terms of successful completion of an action of activity. Learning centers are often enabled by a computer that facilitates the presentations, records, and/or interprets the performance and may assist in pacing and sequence selection.

It must be stressed that a learning center is a program and not merely a facility; it is something you do, not something you buy.

In the conventional instructional environment the responsibility for student performance, discipline, materials selection and often curriculum development is placed on the instructor. He is the focus of the instructional process. One of the reasons for the learning center and the attendent concern for the individualization of instruction is a desire to change the focus of instruction from the instructor to the student. Whether the shift to the learner-centered philosophy of instruction may precede or is the consequence of the adoption of a learning center program, the end result is the same. Regardless of the mode of instruction or the degree of individualization provided, responsibility for progress and performance shifts to the student. The role of the learning center and the instructor becomes supportive in that they must provide the student with the means to achieve the objectives of the instructional program.

Further clarification of a learning center program is found in examining five aspects of any instructional system. These five aspects are:

1. The process of instructional design
2. Student activities
3. Resource selection and allocation
4. Curriculum content and structure
5. Facilities design and utilization

The instructional design process (the methods employed, the emphasis given the process and the thoroughness with which the process is prosecuted) was observed to be a key element in the successful implementation of a learning center program. Without a logically developed and forcefully executed approach to the determination of what is to be taught and the analysis of how those objectives can be met, the learning center cannot be effective. The centers observed have all evolved an approach closely resembling the Air Force's present Instructional System Development (ISD) model. The effectiveness of the centers seems to have been directly proportional to the vigor with which this approach was implemented. The learning center uses a systematic process of instructional design to meet a clear need. Generally, the need was in the form of performance orientation, such as cross training of ...pilots to the DC10 or disassembly and reassembly of IBM selectric typewriters. The result typically was performance oriented training which minimized reading.

The learning center places the responsibility upon the student for his own performance. For most students this did not pose problems. However, some sources presented data which indicated that one in every ten students were not capable of adjusting to the learning center environment without special assistance. Some percentage of failure or wash out rates would be attributed to this problem.

When a learning center program isolates students during instruction, those objectives in which personal interaction is an important element may be ignored. However, several of the learning center programs surveyed have integrated small group discussion sessions into the curriculum. Training the student to function within a learning center program was found to occur, although this time expenditure was minimal.

The learning centers surveyed represented the implementation of many of the fundamental theories related to human learning behavior. They provide for repetition, concentration, the development of associations, the integration of appropriate components to form meaningful structures, and they provide feedback in an expeditious fashion. These centers have integrated appropriately tailored combinations of media, selected and used where they will enhance and guide student learning. Typically student performances were integrated into the programs.

There are a number of alternative approaches to learning center operation. The necessity for installing technological systems has been found by all surveyed learning centers. The results are seen in the area of media hardware selection, allocation and utilization. The survey found very few media hardware configurations which were inappropriate for the instructional objectives of the center. In some other centers media hardware selections appeared to be based on a less than thorough analysis of the center's requirements and the state-of-the-art of the particular media involved. Learning centers typically exhibit an effective application of technology for instruction.

The curriculum reflects the influence of systematic instructional development. It has generally been found that the traditional course structures, allocation of time, sequence of instruction and content of instruction may be incompatable with the effective operation of a learning center.

In those instances where the learning center is designed to supplement or enrich an existing curricular structure, it has little influence on the curriculum and its rate of use is low. When the learning center is set outside the primary instructional context of the parent training system it is often used as a showpiece rather than as an instructional tool and once its novelty has been lost it very often is neglected or eliminated.

The learning centers included in this sample covered an extremely wide range with respect to the size and complexity of the facilities they enjoyed. Learning centers visited varied from those which occupied a single room of less than 100 square feet to those which were completely equipped facilities occupying more than 300,000 square feet. Learning centers were visited which occupied only a single converted classroom to an entire campus converted to function as a learning center. The size and complexity of learning facilities do not distinguish them from other instructional environments. However, the total facilities requirement for learning centers seems to be one of less total space, but space that is designed and equipped for more intensive utilization. Learning center space requirements can be categorized as those which promote concentration, provide for privacy, accommodate the selected media, and ideally provide an environment which is conductive to learning. Inadequate physical facilities may interfere with the instructional design, however, more likely obstacles are lack of organizational support, lack of sufficient funds, and the lack of qualified personnel.

Do Learning Centers Work?

The evidence acquired in the course of the survey supported the hypothesis that learning centers are both effective and efficient approaches to instruction. The data further indicate (see Table 1) that on a relative basis learning centers are a more effective and more efficient approach than the conventional group-paced forms of instruction they have replaced. The data acquired in the survey overwhelmingly support the findings that learning centers in general: require less student time, produce a better qualified graduate than group-paced instructional systems, require less instructor/platform time, and require less capital investment.

The following examples are indicators of the performance of well designed and executed learning centers.

At the college level, the survey data indicate that for redesigned courses the amount of time the students require to reach criterion levels of performance is reduced by 1/3 with an associated reduction in the requirement for formal student-instructor contact time of 50%. The savings in student time have typically been used to provide supplemental or enrichment opportunities to the students. The reduction in instructor contact time has been used for the development of more individualized instructional materials and for increased personal contact between students and faculty.

TABLE 1. Summary of Cost Data

	COST PER INST PACK	SUMMARY COST	SAVING (% OF COMPARABLE PROGRAM)	
CHANUTE AFB IL			25%	Over conventional instruction
DAVIS-MONTHAN AFB AZ				No cost data available
KEESLER AFB MS				
CE OFFICER				No cost data available
CE STAFF				
ELEC PRIN	100M/H		40%	100 M/H not inc photo & dupl
RANDOLPH AFB TX	$746			Module cost - 22 copies
WILLIAMS AFB AZ				See Randolph AFB
FT BENNING GA		$252K		Media hardware only
FT MONMOUTH NJ				CAI exp indicated poss 33% savings
FT RUCKER AL				
AVIATION SCHOOL				No cost data available
HELO MAINT				No cost data available
NTC ORLANDO FL				
TORP TECH				No cost data available
TEST EQ TECH				No cost data available
NTC SAN DIEGO CA			33%	Over conventional instruction
FOREST SERVICE AZ				No cost data available
SCROC CA	$985			Per module
MARITIME INST OF TECH MD				$1000/student/month
AMERICAN AIRLINES TX			33%	Less time than B-707 program
DOUGLAS AIRCRAFT CA				Proprietary cost data
EASTMAN KODAK NY			33%	Less time than conventional
HUGHES AIRCRAFT CA		$30K		Media hardware & courseware
IBM KY				Proprietary cost data
BYU UT		$10.70		Mean cost/stu hr-Conv = $26.00
DALLAS BAPTIST TX			0	Lrn cen same as conventional
ILLINOIS STATE IL	$12-15K			Courseware developed to date
MT SAN JACINTO CA	$150K			Annual courseware development
PURDUE IN		$100K		$35.71/student/year
UNIV OF ILLINOIS IL		$0.50		Per student contact hour

In the industrial setting, the adoption of the learning center concept and the provision of individualized instruction has resulted in a 1/3 reduction in training time and has usually resulted in increased proficiency. These findings were fairly consistent for both operator and maintenance training programs.

In the military training environment the results of the adoption of the learning center approach has had a more variable impact (usually as a direct function of the degree of organizational support available) but the 1/3 savings in student time was still evident for technical training programs. In the military flying training centers surveyed, the learning centers did not support enough of the total training to demonstrate a significant influence on training time. Subjective appraisals of the results of adopting individualized instruction and the learning center concept did indicate that those responsible for the instruction and evaluation of students felt that performance had improved.

Learning centers included in the sample reported that more students reached the specified criterion levels of performance than had previously done so under more conventional modes of instruction. This was reflected in reduced wash-out or failing grade rates for these centers. The rate of failure or number of repetitions on a given module of instruction seemed to be a direct function of the instructional developer's competence, but all centers maintained some form of quality control to insure the refinement of center materials and programs.

Improved efficiency of the training program was often accomplished by an overall reduction in total student time required to achieve the criterion. A fairly uniform pattern emerged from the survey indicating that a 1/3 reduction in student time results from implementation of the learning center. Another interesting aspect of learning center efficiency can be seen in those instances where students not only achieve the specified criterion levels of performance more quickly, but where students are also demonstrably more proficient than those leaving a conventionally designed training program on the same subject matter.

The learning centers included in our survey exhibited varying degrees of effectiveness, largely because of the institutional or organizational structure in which they are embedded. However, the learning centers which seemed more effective were administered under a unified control of both the courseware content and production quality. Courseware requirements were frequently unique for a given center. Local production of courseware materials was frequently associated with the more effective learning centers.

Implementation of the learning center produces equivalent or improved performance at a lower cost than more conventional modes of instruction (see Table 1). These reduced costs are evident in several areas: capital investment, material costs, subsistence costs (where applicable), and operating costs.

It was reported by those learning centers which had built new buildings that the overall capital investment required to build, equip, and furnish a facility tailored to their learning center was less than that required for the conventional facilities that would be required for the same number of students. This statement must be conditioned by two factors. The first being the limited number of sources for this data and the second being the exclusion of those centers in which computer-assisted or computer-managed instruction was utilized. However, most of the centers included in the survey represented conversions in instructional philosophy, strategies, and methods rather than changes in physical plant or location; thus, reductions in capital investment costs are not identifiable.

The development and production of courseware (courseware refers to the instructional materials, print or mediated, which are presented to the student) was found to be one of the major factors influencing the effectiveness of the learning centers surveyed. This is attributable to two factors. The first being the inevitable decision that only locally produced materials tailored specifically to the instructional objectives, resources and student population of the center would meet the center requirements. The second factor is the requirement for less of certain types of materials than would be required for conventional forms of instruction.

Courseware required by a learning center, typically is not available from any source; thus, learning center operators are faced with the alternative of paying someone to develop the materials they need or developing them locally. It has been the experience of the authors and of those learning centers included in the survey that local production not only results in more effective instructional materials, but is also more efficient when such factors as development time, revision time, and production scheduling are considered along with the pure production costs.

The processes employed in the production of courseware at the various learning centers were numerous and varied, tied as they must be to the specific requirements of the selected media, the constraints imposed by the subject matter, and those imposed by the nature and requirements of the student population the center serves. Generally speaking, most of the centers used courseware which had been originated and produced locally to satisfy the technical, instructional, and cost constraints active in the centers environment. Where external operations were used in the courseware production cycle, they were found to have served either of two primary functions. In the most common occurrence, the processing and production tasks associated with the origination and duplication of courseware materials (e.g., text printing, film processing and duplication, audio tape duplication etc.) are allocated to organizations outside the learning center for reasons most often associated with cost, but sometimes for political reasons. A less common occurrence is a center's arrangement with outside organizations to provide complete courseware development services. These arrangements for external courseware development have been tried by almost every center surveyed. However, the results of these arrangements have generally resulted in the learning center itself resuming responsibility for the analysis, objective specification, strategy selection, and script development functions. In some instances even the production tasks have had to be assumed by the learning center's staff in order to achieve the quality required to meet the instructional objectives of the center.

In all instances where student housing, board, and salary costs were a direct responsibility of the learning center, the improved efficiency of the center, e.g. the students completing their training quicker, resulted in significant savings to the center. In certain instances these economics have been quite significant. The Naval Training Center at San Diego, reports amortizing its development costs in the first year through this savings.

Operating costs, those costs other than materials costs and subsistence costs, (e.g., salary costs, expendables, maintenance, etc.) were found to be less than what would be required to support conventional instruction for the same size population. These savings accrue in several ways, but most prominently in the area of the requirement for instructional staff. Changes in instructional staffing costs were found to be of two types-reduction in the actual numbers of instructor contact hours required and a shift in the requirements for the kinds of talents required to support instruction in the learning center.

The first of these changes was due to increased reliance on various instructional media to carry the burden of transmitting the volumes of factual information found in many instructional programs. This reduction in student contact hours does not necessarily mean the elimination of instructional positions rather it implies changes in the instructors role from that of information transmitter to that of analyst, counselor, and instructional developer. Associated with this was an emphasis of student performance oriented needs. The result is courseware which enables a performance oriented training which minimizes reading skill requirements.

Change in the instructors role is closely tied to the second area of cost savings - the use of different types of personnel (often at lower salary costs) to perform many functions presently performed by instructors in conventional instructional systems. This substitution has been successfully accomplished in both academic and commercial institutions and is exemplified by the IBM approach to learning center operation.

Why a Learning Center?

One of the underlying characteristics of the learning center is a commitment to the individualization of instruction. Operationally the purposes underlying the establishment of the learning centers surveyed were fairly diverse. The purpose for establishing a given center can be summarized as: efficiency, effectiveness, and change in instructional philosophy, or far more likely a combination of these three.

The learning centers included in this survey were established to answer the specific requirements of the student population and the operational environment they serve. The reasons advanced to support the establishment of these centers covered a wide range. The need to establish a drawing card or gimmick to attract students was one reason. The results of extensive and intensive assessments of the instructional mission to the center and a systematic program to develop the optimal instructional environment to match the requirements of that mission provided another reason. In some instances the learning center, per-se, is an evolutionary development which occurred as the corollary of a larger instructional development program (e.g., Davis-Monthan AFB, Brigham Young University etc).

Table 2 presents a summary of the reasons given by the various centers as to why they were established. The reasons given at each center have been categorized as shown; while this categorization does eliminate some of the immediacy of the verbatim responses from each center, it is a useful comparative tool.

The student populations served by these centers were as diverse as the centers and their locations. In this sample, centers can be found serving high school dropouts (Mt. San Jacinto City College and the Southern California Regional Occupational Center), college students at all levels, (University of Illinois, Brigham Young University, etc.), entry level enlisted military trainees, (Naval Training Center, San Diego, Chanute AFB, etc.), as well as centers providing professional training to college graduates in a myriad of complex skills, (American Airlines, Williams AFB, Eastman Kodak etc.). This broad range of student characteristics does not lend itself to neat, orderly definition. The student population included in this survey is definable in terms of its limits rather than in terms of its composition. This survey deliberately excluded learning centers which were designed to serve elementary school children, as well as those designed for students with physical or mental handicaps. The centers included in this survey were selected to be representative of the present state-of-the-art in learning center design and operation for populations which are directly analogous to those involved in Air Force technical training.

The range of subject matter covered in the selected centers was almost as diverse as the character of the student populations served. The centers surveyed covered the range from remedial reading through graduate studies in history, from basic electricity through the functioning of aircraft and ship power systems, and from basic military courtesy through advanced tactics. Rather than attempt to enumerate the exact courses of instruction provided in the various learning centers, the authors feel it is safe to indicate that the spectrum of instruction offered in this sample of learning centers is very much parallel to the offerings of the Air Force training program.

TABLE 2. Rationale for Center Establishment

	LEARNING CENTER RESEARCH PROGRAM	BETTER FACILITY UTILIZATION	BETTER STAFF UTILIZATION	BETTER STUDENT TIME UTILIZATION	BETTER COST-EFFECTIVENESS	BETTER TRAINING	USE STUDENT CENTERED INSTR	USE BEHAVIORAL OBJECTIVES	EXTERNAL PRESSURE
CHANUTE AFB IL				2	1	2			
DAVIS-MONTHAN AFB AZ		2		2	2		2	1	
KEESLER AFB MS									
CE OFFICER				2			1	2	2
CE STAFF				2			1	2	
ELECPRIN				1			2		
RANDOLPH AFB TX		2		2	1	2		2	
WILLIAMS AFB AZ	2			1		2	2		
FT BENNING GA				2		1	2	2	
FT MONMOUTH NJ	2	2	1	2	2		2	2	
FT RUCKER AL									
AVIATION SCHOOL						2	1		
HELO MAINT				2		2		1	
NTC ORLANDO FL									
TORP TECH	1							2	2
TEST EQ TECH						1			
NTC SAN DIEGO CA	2	2	2	2	2			1	
FOREST SERVICE AZ						1			
SCROC CA		2	2		2			2	1
MARITIME INST OF TECH MD		2			2	2			1
AMERICAN AIRLINES TX			2	2		2	1		
DOUGLAS AIRCRAFT CA		2			2			1	2
EASTMAN KODAK NY		2	2	2	2	1		2	
HUGHES AIRCRAFT CA		2	2			1			2
IBM KY		2	2	2	1			2	2
BYU UT	2				1	1	2	2	
DALLAS BAPTIST TX	1	2	2	2				2	
ILLINOIS STATE IL		1	2	2		2			
MT SAN JACINTO CA		2	2	2			2		1
PURDUE IN		2	1	2					
UNIV OF ILLINOIS IL	1		2		2		2		

1: Primary reason 2: Other reason for establishing learning center

How Does a Learning Center Function?

The learning centers included in this survey provided instruction to a diversity of student populations in terms of size, composition, goals, and motivation. In order to service these different student populations and instructional situations a variety of organizational structures are used. The number of instructional and support personnel in any given center would seem to vary as a function of number of students and the instructional strategy being employed. A wide variety of organizational structures were observed, functioning at various levels of effectiveness.

The most effective learning center organizations (in terms of developing and conducting cost-effective instruction) used an authoritative leadership structure, incorporating unified control of courseware content and production quality. Most common weaknesses eliminated by this organizational structure appeared to be inadequately prepared instructional objectives, poorly developed courseware, lack of actual student performances, and poorly produced courseware. The technical expertise and experience of the authoritative manager was considered responsible for eliminating these failings.

Nine other functional areas of the learning center will be discussed. These are:

1. Budget.
2. Courseware production.
3. Student scheduling.
4. Courseware distribution.
5. Courseware maintenance.
6. Equipment selection and maintenance.
7. Acquisition and operating costs.
8. Operating procedures.
9. Physical Configuration.

Budget. The budget of any learning center is very quickly translated into the resources available and the manner in which these resources may be used. Regardless of the size of the center, the population it serves, or the present size of the budget, there is a common bond in that all centers express the need for a larger budget.

Because of the diverse nature of the budgetary sources and accounting systems under which the centers in our sample operate, it is not possible to develop a coherent picture of budget impact on the logistics of center operation. The qualitative impact of these budgetary levels can be detected in the attitudes of students and staff toward the centers equipment and courseware; these materials are viewed as working elements in the instructional process and they are employed whenever and wherever they are appropriate.

Courseware Production. The most pervasive problem in learning center development and operation is the establishment and operation of a courseware production capability. Given that the center's goals have been established and that an instructional strategy has been established, the next major task to be accomplished is the design and development of the center's courseware production capability. Very specifically the courseware would specifically be designed to meet the unique performance oriented needs of the learning center. In terms of the survey results, the response to this problem can be divided roughly into two classes: those who established and now operate their own production capabilities, and those who have placed the burden for courseware production on some individual or organization outside the learning center organizational structure.

In the first class we would place centers such as Brigham Young University, IBM, and Purdue University. At these centers and others in the same class courseware production (analysis, objective specification, narrative generation, scripting, recording, photography and packaging) is carried out with little, if any, outside assistance. Typically the courseware production cycle in these centers is a central element in the success of the center and is acknowledged as such by the center's management and peers. Courseware production at centers in this category is handled by a specially designated production group which has the manpower and equipment to perform these tasks. The technical qualifications of the personnel engaged in these tasks are diverse; the one striking similarity across centers seems to be the sincere interest and commitment displayed. Equipment available for the courseware production tasks required at these centers can be classed as belonging to that somewhat ambiguous category which falls between consumer goods and professional gear. The amount of gear available is directly proportional to the finances behind a given program, but most commonly is limited to a single item of major equipment for a set of tasks (photography, recording, etc.) which is time-shared between origination, editing and duplication tasks. Again, it is the skill and dedication of the personnel who make the equipment into a capability rather than a limitation.

In the second class of centers we would place centers such as the Southern California Regional Occupational Center, Fort Monmouth's COBET system, and Douglas Aircraft. At these centers courseware development is carried up to the point of narrative or script development; at that point the problem of courseware production is turned over to an outside organization which handles all production, duplication, and packaging tasks. The extent of this outside support may be as little as graphics or photography or it may involve script development, storyboard creation, graphics, photography, test development, etc. The one common factor across the centers which have been successful with this type of operation is the existence of a function which can be called production coordinator, account executive, media czar or whatever. This function, normally held by a single individual, becomes the focus of the center's courseware production operation. He is responsible for source selection, training, and quality control.

The techniques used for the production and display of visual instructional materials fall into four classes: 35mm slide, filmstrip, movies, and television.

Eighty percent of the centers visited used 35mm slides. In almost every instance these visuals were in use as elements of a prenarrated slide presentation; other applications included use as illustrative material during live or televised lectures. At all of the centers employing prenarrated slide presentations the processes for slide production were essentially the same. Responsibility for determining the content of the slide lies with the author of the instructional package. The mix of "live" photography to artwork and textual slides was found to be 40% to 60%. This high ratio of artwork and textual slides requires continuous association between the author and his graphic arts support. The criticality of the interaction between the author and the available graphic arts support has led several of the larger organizations to designate one or more individuals to handle this activity. Live photography and the preparation of original imagery from artwork and textual materials was done locally in all but one or two instances when this task was allocated to a photo operation external to the center. While several of the centers visited were equipped to process 35mm color film, most of the centers relied upon photographic laboratory facilities external to the learning center for processing and mounting of original and duplicate slides.

Filmstrips were used by 18% of the centers visited. Most of these were using 35mm filmstrips; however, four centers were using Super 8mm filmstrips and one was making use of 16mm filmstrips. The production of these filmstrips (in all three formats) differed from the production cycle described above, in that all processing, duplication, and special packaging was handled by commercial laboratories. In only one center was any second generation photography handled by the learning center; in all the remaining centers using filmstrips transparencies, prints, and artwork were provided to the commercial laboratory.

Movies, both 16mm and Super 8mm, were employed in the learning center context by 18% of those sampled. These presentations were produced by organizations outside the learning centers using them.

Television, both live broadcast and videotape, was found in use at 29% of the centers included in the survey. Seventy-five percent of the centers were found to be using videotape presentations and 38% of those employing TV were employing it to transmit live broadcasts. In centers employing videotape presentations, almost all production activities were performed within the learning center itself. The centers making use of live broadcasts were found to draw their programs from a diverse variety of sources.

Student Scheduling. Only a minority of the centers included in the survey were of such a size, or design that student scheduling was not a problem (e.g., IBM, Mount San Jacinto College, American Airlines). Even in these there was no guarantee that a change in student flow, for example, would not generate problems. For the majority of the centers in the survey, the problem of student scheduling was one of more students than resources and thus systems had to develop which would allow the fairest distribution of resources. This process takes several forms (e.g., specifically assigned shifts in the learning center, scheduled activities within which learning center time must fit, etc.) but the intent is the same; that is to control the progress of students through the system.

Courseware Distribution. A learning center's courseware distribution process or system is very closely tied to the budget, student load, and scheduling aspects of the program. In the course of this survey three loose categories of distribution systems were identified; these categories were not mutually exclusive, at any given center one or more could be operating simultaneously. The categories are:

1. Centralized Distribution - which is typified by the CCTV cable systems at Fort Monmouth and Brigham Young University and by the microwave inter-campus broadcast system employed at Dallas Baptist College.

2. Local Distribution - which is within a room or area of a center, the materials are held and distributed to students as in a conventional library.

3. Open Storage - in which material is available at or near a learning station. It is available at all times; most commonly for simple mediated materials.

The three categories are also roughly descriptive of the sophistication of the distribution and presentation systems observed during the survey. On the one hand we have those centers making use of CCTV, some for as long as 16 hours per day; while others restrict themselves to textual materials in the form of programmed texts or workbooks. The largest percentage of the centers employ mediated instructional materials either for presentation to groups or for individual study and these materials are easily accessible and are designed for local, rather than central, presentation. The most popular non-print media were observed to be the prenarrated slide presentation with videotapes/video cassettes next, and films and filmstrips used for the least amount of time.

Courseware Maintenance. The maintenance and revision of instructional courseware was handled quite differently across the sample of centers. In some centers it was left to the instructors discretion, in others courseware is revised every time a program is given. However, the most frequently observed approach was that of a review by the instructional development group after a prespecified period of time and then a complete recycling of the instructional development process. Only two centers visited were set up to provide continuous updating and revision of the instructional materials available to the student; the remainder were only able to replace complete instructional packages.

Physical care and maintenance of courseware materials were of minimum concern at the learning centers in this survey. The typical attitude was of care in production and storage, and the provision of adequate spares to replace damaged or missing materials. With the exception of the cleaning and inspection of movie films, little systematic attention was given to the physical care of courseware materials during their operational life. A systematic program for the physical care of courseware should be developed and implemented.

Equipment Selection and Maintenance. The greatest variance among centers, in the area of equipment selection and maintenance, was with their initial equipment selection procedures and the detail and accuracy of their maintenance records. The majority of the centers included in the survey had performed only the most rudimentary form of analysis in selecting their equipment and maintained no record at all of equipment performance. Only three organizations (Brigham Young University, IBM, and Randolph Air Force Base) had records systems which lend themselves to supporting selection decisions and documentation of equipment reliability under measured instructional usage.

All centers had personnel who were capable of performing organizational level maintenance (bulb replacement, lubrication, cleaning, etc.). More complex maintenance activities were generally delegated to organizations outside the learning center. Only a few centers were found to have the volume, staff, and budget to support intermediate and depot level maintenance.

Acquisition and Operating Costs. Instructional costs, capital, operating, development, etc., are a very real problem in any learning environment. It was felt that in the course of this survey that it would be possible to obtain some overall grasp of the costs associated with instruction in a learning center environment. While it was possible to establish the factors which influence the cost of instruction in such an environment, it was not possible to establish the real costs of instruction on any systematic basis.

Documentation of costs as reflected in Table 1 is not generally available. Most people either don't know or are unwilling to find out what the costs really are. Cost data was simply not recorded or was not collected in a fashion which would permit its identification. Various cost accounting systems further confound the issue.

Operating Procedures. A wide variety in learning center operating procedures was observed during this survey. Generally speaking, all of the centers operated on a similar basis with respect to their users; learning centers remained open from 12 to 18 hours per day and the students used the center on their own schedule. Students paced their own time in the center or they were paced by the nature and content of the presentations. Only a few exceptions to this pattern of operations were observed (see Dallas Baptist, Eastman Kodak, IBM, Keesler Air Force Base); in these learning centers student access to instructional materials was controlled and scheduled in a more rigid fashion, e.g., training begins at 0800 and shuts down at 1700, or the program of instruction is broadcast only at fixed intervals.

Operating procedures governing courseware preparation differed markedly between centers, both as a function of the production philosophy of the center (or its parent organization) and also of the presentation medium being used by the center.

Physical Configuration. What does a learning center look like? Each and every learning center included in the survey differed on any number of parameters. Included in the survey were learning centers which were a single room located at each operational office (see IBM) of a firm, centralized single purpose centers (see Eastman Kodak & Williams Air Force Base for examples) up through centers which constituted the entire campus of a college (see Dallas Baptist & Mt San Jacinto).

There are several physical features which are more or less common across the center surveyed. These include provisions for individual study, physical provisions for the distribution of selected instructional media, facilities for local production of courseware and what can generally be described as a functional yet aesthetic approach to the design and architecture of the learning center. The more effective centers also emphasized performance oriented training which minimized reading (such as cross training pilots to the DC10 or disassembly and reassembly of IBM selectric typewriters).

In providing space and accommodations to facilitate individual study, a common denominator across all centers seems to be some type of study carrel. Roughtly 50% of the centers surveyed used carrels that were locally designed and fabricated, while the remaining centers used commercially available carrels. The carrels were utilized for a common function; they are the focus of the instructional efforts during this phase of the individuals training. The student is expected to work in a carrel. In those instances where audio-visual media form an integral portion of an individual's instruction, this focus on the carrel is automatically reinforced by placing the presentation system in the carrel. While carrel size, finish, and arrangement varied markedly from installation to installation it was only in those few crude prototype fabrications the carrel design or structure interfered with the instructional process. The major characteristics of the carrel system which was observed to influence student behavior or to generate student comment was the accessibility within the carrels with respect to courseware loading and removal. Since this characteristic is a function of the media used, the requirements for accessibility differed in each instance.

The requirements - for physical space, electrical service, distribution channels, etc. - varied as a function of the nature of the media employed, the centers physical configuration, the carrels used and, to a certain extent, the centers instructional strategies. All of the centers included in the survey had given specific consideration to these requirements and had designed or modified their facilities to insure service while maintaining adequate provisions for personnel safety, etc. The major physical parameters and services which were observed to have been given specific attention were: power distribution to support the audio-visual presentation systems, video distribution (in those centers where centralized video systems were used), lighting control (particularly where group presentations have been retained), and acoustic control for study spaces.

One of the overall impressions after visiting any selection of the centers surveyed is that these facilities, regardless of their size, have had some amount of attention given to the creation of an environment which is more analogous to a modern office than it is to the classic concept of a school room. Through the judicious use of paint (in other than institutional tones), carpeting, and colorful upholstery material, an impression of comfort/functional utility has been created. Some of the centers included in the survey were classrooms, and some of these were vintage, but even in these, attempts had been made to change the overall impression that the facility creates in an observer or student.

IV. SURVEY DATA

The following pages include a condensation of the information gathered during the course of the survey. Each summary is designed to identify the center, identify the center's student population, delimit what the function of that learning center is, how that function is performed and point out the effectiveness of the center. In addition, any particularly innovative features of the center worhty of special mention are pointed out in the text or in the accompanying photographs.

Specific attention has been given to the following aspects of each learning center.

1. Instructional Development - The survey data for each center has been analysed to bring out the manner in which the subject matter, objectives and tasks to be taught is identified and prepared for student use.

2. Courseware Production - The term "courseware" is used to denote the instructional materials produced or procured specifically for the students use. Depending on the center, this may be a simple matter of formatting, typing, and duplicating x number of copies of written material, or it may involve the production of broadcast quality presentations for television. Our attention in this section is focused on the processes used and the success of the center in producing or obtaining courseware.

3. Maintenance Philosophy - Each centers approach and procedures for courseware and equipment maintenance.

Table 3 provides a summary of the learning centers included in the survey.

TABLE 3. Learning Center Summary

	GOAL			TYPE INSTR				RESOURCES									
	KNOWLEDGE	SKILL	ATTITUDE	INDIVIDUAL	TEAM	SMALL GROUP	LARGE GROUP	SIMULATORS	EQUIPMENT	TNG DEVICES	BOOKS, MANUALS	LECTURE/DEMO	PRENAR SLIDES	AUDIO ONLY	SUPER 8MM/16MM	CAI	TELEVISION
CHANUTE AFB IL	x	x		P	x				x	x	x		x	x	x		
DAVIS-MONTHAN AFB AZ	x	x	x	x		P		x	x	x	x	x	x	x	x		x
KEESLER AFB MS																	
CE OFFICER	x			P	x	x					x	x	x	x	x		
CE STAFF	x			P	x	x					x	x	x	x			
ELEC PRIN	x			x		P			x		x		x	x			x
RANDOLPH AFB TX	x	x	x	x		P			x	x	x	x	x	x	x		
WILLIAMS AFB AZ	x	x	x	x		P		x	x	x	x	x	x	x	x		
FT BENNING GA	x		x	x			P				x	x	x	x	x	x	x
FT MONMOUTH NJ	x	x	x	P		x	x		x	x	x	x	x	x	x		x
FT RUCKER AL																	
AVIATION SCHOOL	x	x	x	x		P		x	x	x	x	x	x	x	x		
HELO MAINT	x	x		P	x				x	x	x		x	x	x		
NTC ORLANDO FL																	
TORP TECH	x	x		x			P		x	x	x	x	x		x		x
TEST EQ TECH	x	x		P					x	x	x		x	x	x		
NTC SAN DIEGO CA	x	x		P					x	x							
FOREST SERVICE AZ	x				P	x			x	x	x	x		x			
SCROC CA	x	x	x	x	x	x	x		x	x	x	x	x	x			
MARITIME INST OF TECH MD	x	x			P	x		x	x	x	x	x					
AMERICAN AIRLINES TX	x	x		P	x	x		x	x	x	x	x	x	x	x		x
DOUGLAS AIRCRAFT CA	x	x			x	P		x	x	x	x	x	x	x	x		
EASTMAN KODAK NY	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	
HUGHES AIRCRAFT CA	x	x	x	x		P			x	x		x					
IBM KY	x	x	x	P					x	x	x			x	x		
BYU UT	x	x	x	x		P	x		x	x	x	x	x	x	x	x	x
DALLAS BAPTIST TX	x	x	x	P		x				x	x	x	x	x	x		x
ILLINOIS STATE IL	x			P							x		x	x			x
MT SAN JACINTO CA	x	x	x	x		x	x		x	x	x	x		x			
PURDUE IN	x			P		x					x		x	x	x		
UNIV OF ILLINOIS IL	x			P										x		x	

P - Primary type instruction.

CHANUTE AIR FORCE BASE
Rantoul, Illinois
(Aircraft Electrical Repairman's Course)

The Aircraft Electrical Repairman's course is designed to train airmen to maintain aircraft electrical systems and components. Specific functions covered include inspection, troubleshooting and repair. The course has been converted to a self-paced program of instruction and is conducted in such a manner and under such conditions that it is representative of the present state-of-the-art in learning center implementation within the military.

The present program was developed with the aim of improving the effectiveness of training. The original course was of 16 weeks duration; conversion to self-paced instruction has allowed an average 20% reduction in course time (from 16 to 12-13 weeks). This has been accomplished with airmen right out of basic training at the rate of about 20 students per week.

Programmed texts account for approximately 60% of the instruction provided, with systems trainers (training devices providing for system manipulation with the opportunity to observe system reaction) accounting for 35%; other instructional media including Super - 8 mm films, 35 mm slides and 16 mm films account for the remaining 5%.

This course is the first Air Training Command technical training course having a large student flow that has been converted to a totally self-paced course. Within the constraints of existing facilities, fixed objectives and low level funding, this course is more effective; students are progressing through the system more quickly and they are performing at an equivalent or higher level than students from the original program.

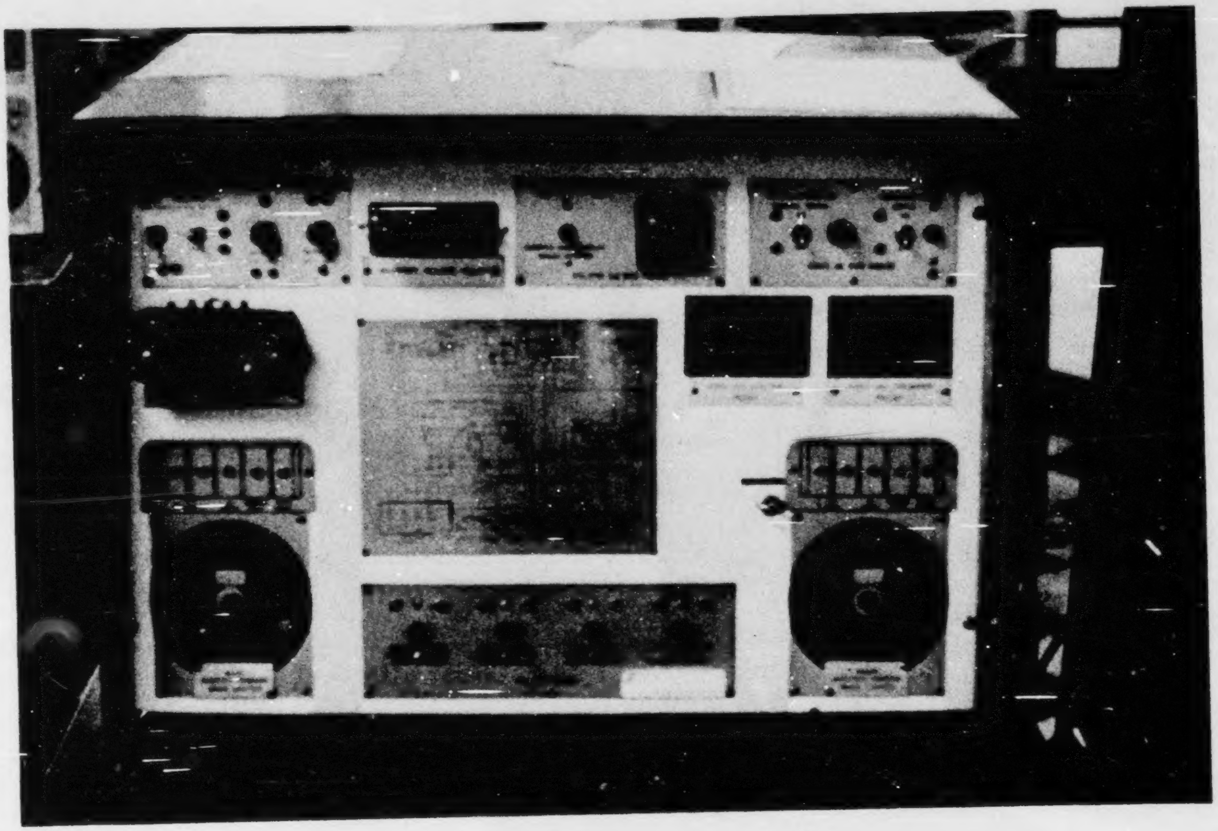
COURSEWARE DEVELOPMENT

The selection of the Aircraft Electrical Repairman's Course as the first technical training course at Chanute AFB to be converted to individualized, self-paced instruction was carried out by the Air Training Command. This particular course was chosen because it has a large student flow and would, therefore, provide an effective vehicle for the evaluation of the benefits of an individualized self-paced instructional approach.

The original strategy in structuring the course was that the primary media would be programmed text supported by trainers. All of the original material was developed by the course staff with programming support from the Training Center. At the present time, all updates to the texts and training material are performed by the course instructors, with the exception that any Super - 8 or 16 mm films are developed and furnished to the course by ATC.

Classroom view showing students at work using program texts and supportive training aides.

Representative "hands-on" trainer classroom configuration.



Close-up view of Inverter System troubleshooting trainer panel.

COURSEWARE PRODUCTION

The courseware production process for the course went as follows:

a) The course instructors, recognizing the need for rewrite or modification of the text materials or the requirement for new materials, generate the materials required.

b) The developed materials and/or aids are then submitted for approval by the School of Applied Aerospace Sciences. Once approved, the new materials are then produced in the required quantity by the school with base printing support for official course use.

MAINTENANCE PHILOSOPHY

Maintenance (update, corrections, modifications) of the programmed texts is the responsibility of the course instructors. Quality control is supported by technical school inspections conducted by the ATC IG twice yearly and by a Stan-Eval inspection every 3 years.

In the maintenance and repair of the supporting trainers and training devices, course personnel are supported by the base maintenance and service group.

DAVIS-MONTHAN AFB AZ
355th Tactical Fighter Training Squadron

The A-7D pilot training program, presently being conducted at Davis-Monthan AFB, is the first operational fighter pilot training program to be designed using the Systems-Approach to Training (SAT). SAT is the name assigned to the application of Instructional System Development (ISD) techniques to the design of flight crew training programs within the Air Force.

The A-7D program was redesigned to provide more effective training in an era of limited resources, changing roles and new equipment. In the development of the pilot training program, the A-7D ISD team has investigated and is using a large variety of media, of primary interest to this study was their use of television.

In the A-7D program a good deal of experimentation has been done with a prototype Airborne Video Recording System operating through the Head-Up-Display (HUD) of the A-7D Aircraft. In addition, they have developed their own video studio/production facility which they have put to rather extensive use in supplementing the academic training efforts of the squadron.

Completed efforts with the airborne video recording system prototype have convinced the A-7D training team of it's applicability and effectiveness. As with any prototype, the system was not without problems which must be corrected if an effective operational system is to be developed. Some of the problems encountered during prototype testing included:

a) Vibration of the optical platform,

b) Glare from the aircraft glare shield washing out the recorded imagery,

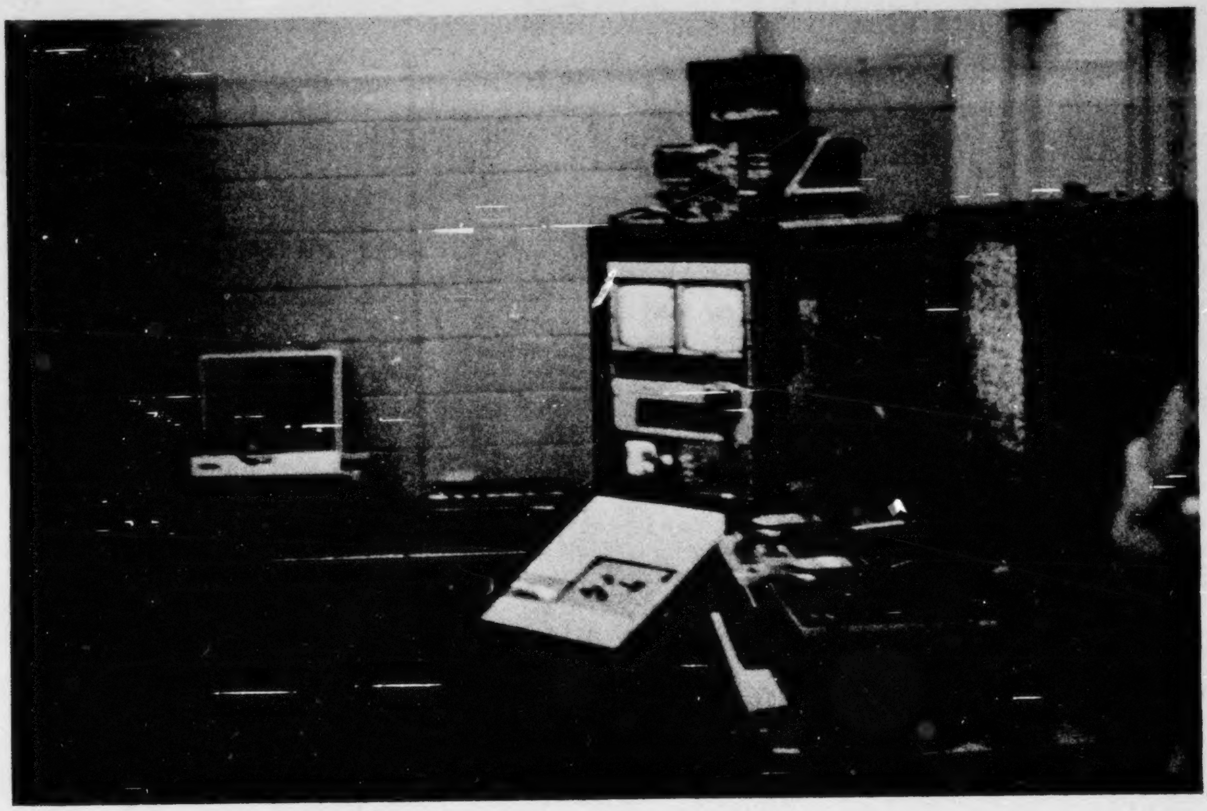
c) Vidicon tube burn spots from sun glare,

d) Objectionable levels of background hum and noise in the prototype audio recording system.

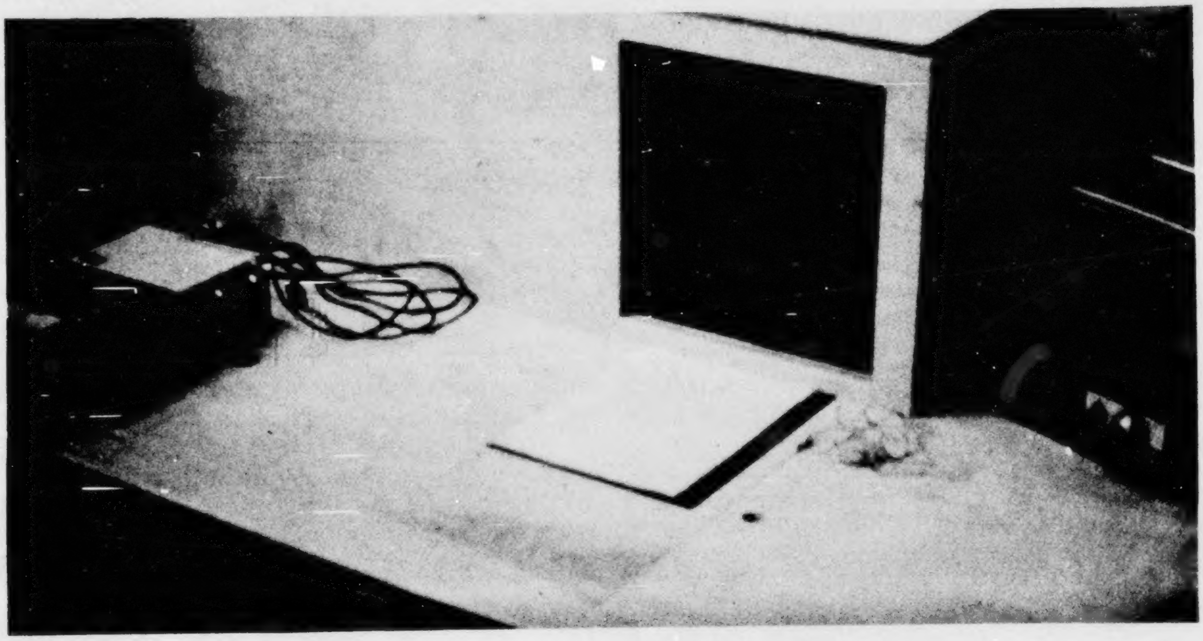
Further efforts on the development of an improved inflight video recording system must await requested funding approval; details of this program can be found in Fitzgerald (1971).

While the A-7D program does not represent a total adoption of the learning center concept, it is the closest operational approximation of such a program within an Air Force flight crew training program.

Within the limits of the facilities, equipment, and funding available to this program, the philosophy and certain aspects of the learning center concept have been adopted. The results of these tentative steps have been impressive enough that the A-7D program is serving as a model for future Air Force instructional development efforts in the pilot training area.



Video studio control room for the review, editing and splicing of developed materials.



Student study carrel with video, sound/slide and audio tape capability.

COURSEWARE DEVELOPMENT

The major portion of the courseware developed to date for the A-7D training course has been the responsibility of the Instructor Pilot staff under direction of the Instructional System Development Team (ISDT). Each instructor has recorded his classroom lectures on video tape working with the video production facility personnel. In addition, some flight simulator briefings, phase briefings and supplemental subject matter presentations have also been recorded. A limited number of sound/slide presentations have also been developed with plans for additional development as time and resources permit.

These video tapes and sound/slide presentations are available in the A-7D study carrel area for student use on a voluntary basis, either to supplement regular course presentations or to allow students to make up lost time due to absence or illness.

COURSEWARE PRODUCTION

A firm courseware production procedural plan has not yet been established with the A-7D training course. Tentative planning calls for the establishment of audio/visual production requirements based upon the results of the training analysis and procedural analyses to be completed by the ISD team. The resultant production requirements would then be coordinated with the production facility personnel for scheduling. The present effort is directed toward script/scenario development by the ISD team members prior to production facility coordination and scheduling.

MAINTENANCE PHILOSOPHY

All equipment maintained within the production facility is primarily the responsibility of facility personnel. However, base level support is available and supplied as required.

Courseware maintenance is the responsibility of the ISD team and the course instructors as the training proceeds with the new materials.

KEESLER AFB
Biloxi, Mississippi

At Keesler AFB, three training/learning environments were surveyed. These included:

1) Communications - Electronics Officer Training Course

2) Communications - Electronics Staff Officer Course

3) Airman Electronic Principles, Self-Pacing Branch

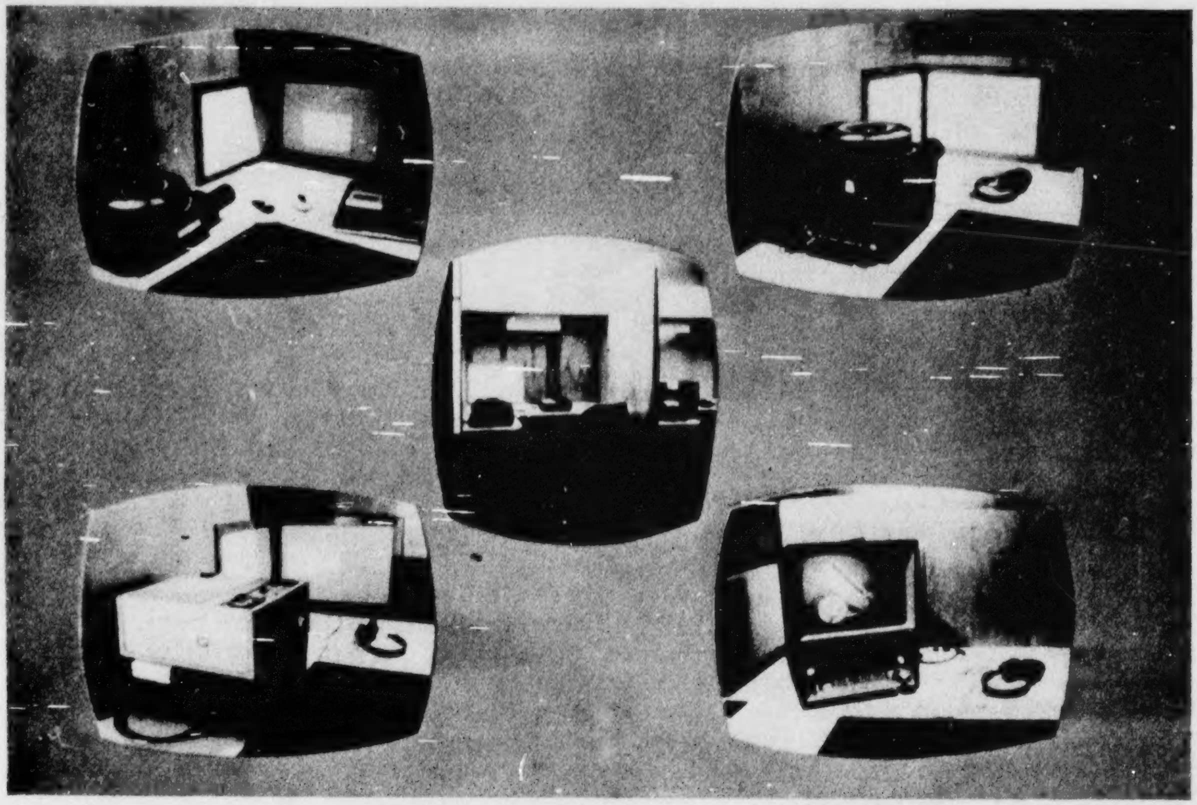
(1) The present Communications - Electronics Officer training course was established in December 1969. The design philosophy of the present course was that since all entering students are college graduates, treat them as college graduates in graduate school, treat them as officers not airmen - as had been the tendency in the past, and develop "modular" training programs. Entering students receive a diagnostic test to determine weak spots in basic principles - the goal being to teach the student what he doesn't know rather than what he already knows. Based on the diagnostic scores the counselor and the student select the students' curriculum. The student, as much as possible, is allowed to select the media he wants to use. Audio-Visual "packages" are available for each of the modules. These packages consist of an illustrated booklet, audio tape, and a student response booklet. There is also a library of 114, 16 mm films. There are 50 study carrels available, 14 of which are active A-V carrels and the remainder "dry" study carrels.

At the present time, limitations on the availability of audio-visual production support have delayed the conversion of the modules from their present form into sound/slide packages.

(2) The Communications - Electronics Staff Officer course is conducted at the Air University graduate level and covers three major subject areas. These are:

- Management
- Systems Engineering
- Systems Employment

Training "Modules" have been developed for all three areas. Management, for instance, is made up of 15 modules. However, there is only enough time in the seminar/group instruction presentation for 12 of these modules. The student selects 4 modules he feels he does not need. In the learning center, all modules are available so that those students who are not sure of which modules they can eliminate, or those who feel they cannot eliminate any, can still have access to the information. The learning center, in this instance, is back-up to the regular course group lectures and seminars.



The same basic carrel configuration is used at Keesler to accommodate a variety of audio visual equipment.

ypical sound/slide study carrel configuration.

(3) The Airman Electronic Principles course at Keesler is taught in two different ways. The conventional course takes 18 weeks and is taught in the lecture/demonstration manner. The Self-Paced Branch takes students in the top 20% of a class and gives them the self-paced version of the Electronic Principles course. The self-paced course is taught using programmed texts almost exclusively. Since all students study in the same room and all use the same materials, but are all at different points in the program, the label appended to the program is the "Little Red School House".

The self-paced program has been quite successful with average students in the program completing it in 9 weeks.

COURSEWARE DEVELOPMENT

All courseware developed for the four training/learning environments surveyed at Keesler have been the responsibility of the instructional staff in each program. The only exceptions are the 16 mm films used in the various courses. These are provided through ATC channels.

COURSEWARE PRODUCTION

Courseware production has presented quite a problem, especially for the Communications - Electronics Officer training program at Keesler. Course staff personnel have experienced as much as a 12 month procurement time when relying on production of materials by the base support group. As a result a "Task Force Plan" has been developed. In this approach, an Instructor, Visualizer (Artist), Author team from the school are assigned responsibility for the development of a lesson. Their experience, using this approach, has shown that a "team" can produce a 20 minute lesson (audio-visual) in approximately four days. They are now proceeding to convert all of the course materials using the "task force" approach.

MAINTENANCE PHILOSOPHY

Maintenance of course software is, generally speaking, the responsibility of the staff members in each course. Modifications and updates to course materials are handled on an as required basis.

The maintenance of hardware, tape recorders, 16 mm and 35 mm projectors, etc., is handled by staff personnel to the extent possible, with base support supplied for the more complex failures.

RANDOLPH AIR FORCE BASE
Learning Center Support Division
Pilot Instructor Training Learning Center
San Antonio, Texas

Learning Center Support Division

The Learning Center Support Division (LCSD) is an activity of Air Training Command Headquarters. Its responsibilities are:

- To define the courseware requirements for the Air Training Command's Flying Training programs.
- To develop and distribute standard courseware to each Flying Training Learning Center.
- Provide reporduction services for all Flying Training learning centers.
- To review completed courseware packages for possible revision requirements.
- To conduct research to determine the latest advancements in programming techniques, production methods, audio-visual technology and equipment.
- And conducts field reviews of completed courseware.[7]

In operational terms, LCSD operates as both a production coordinator for all of the Air Training Commands, Flying Training Learning Centers and it also produces courseware for the Flying Training Learning Centers at Randolph Air Force Base. One of the unique aspects of the LCAD's operation is that it is the hub of a loosely, integrated network of learning centers. In its coordinating role, LCSD receives courseware developed by a learning center at another Flying Training Base - including visuals, narration and a script - assembles this into a complete package in accordance with established procedures, duplicates the courseware package and then distributes copies not only to the originating base, but also to every other base conducting that type of training.

This system possesses definite advantages in terms of the rapid acquisition of courseware without the establishment of a vast production center. It has certain disadvantages in that despite the similarity in training, background and organizational structure each Flying Training Base operates under unique local conditions which makes the use of courseware (particularly the visual component) less than one hundred percent useful.

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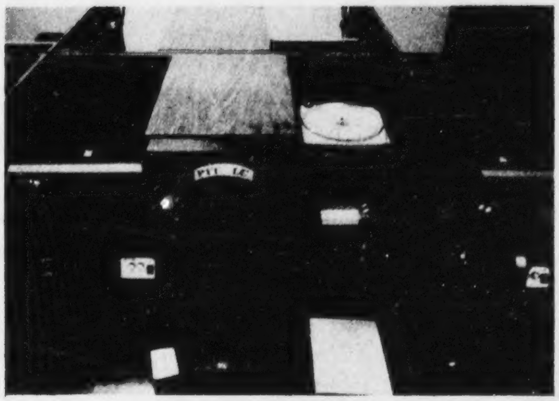
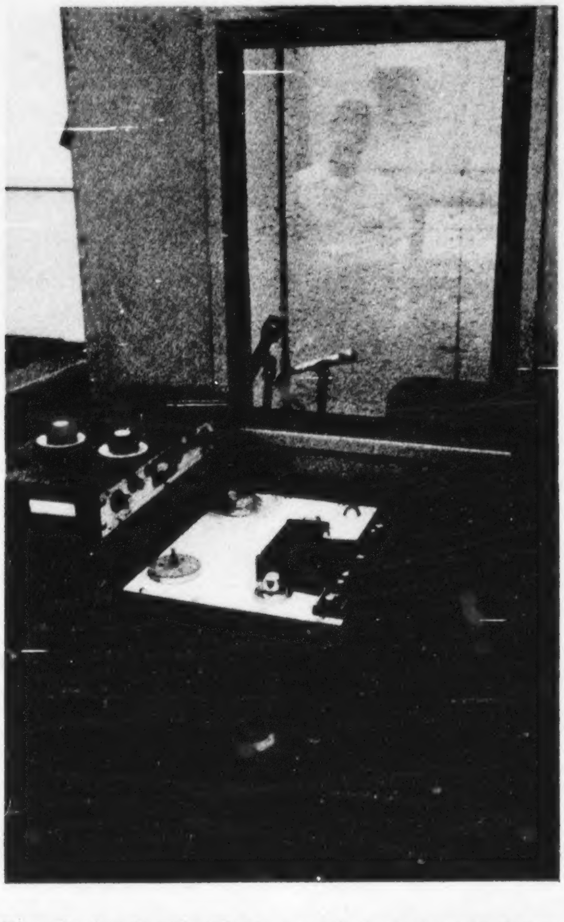
[7] Adapted from Department of The Air Force, Air Training Command Regulation 51-22, dated 11 February 1972.

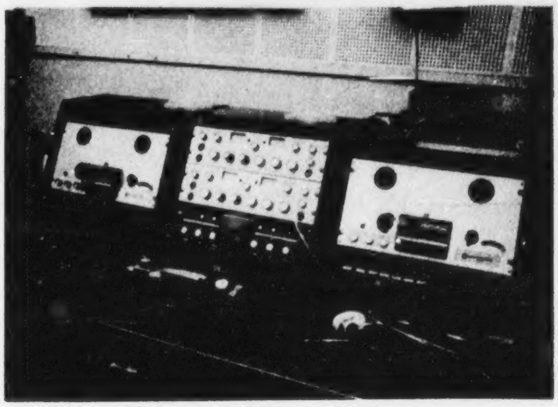
Study carrel configuration in the PIT Learning Center.



Individual PIT Learning Center study carrel. Carrel features a synchronized sound/slide system consisting of a slide projector (upper right of carrel), cassette playback unit (on-shelf below slide projector), display screen (center), and system controls (control box on the work surface). This carrel also provides space for a cartridge load Super-8 mm projection system (left hand display).



Recording booth and studio tape recorder in the Learning Center Support Divisions Audio Lab.



Audio mixing equipment in the LCSP Audio Lab.

Pilot Instructor Training Learning Center

The Pilot Instructor Training (PIT) Learning Center at Randolph Air Force Base is an integral element in the Pilot Instructor Training (PIT) course. This course is designed to train qualified T-37 and T-38 aircraft pilots to act as flying training instructors for those aircraft. At the time of our visit the center was being used approximately one thousand hours, per month by about fifty six students per day or twenty six percent of the student population. The center consists of several ranks of study carrels designed and built by Air Training Command. These carrels were equipped with 35 - mm slide projectors, audio cassette playback units, and Super-8 mm film projectors. The center had courseware available to support seven hours of required training and one hundred hours of supplementary training.

The opinion of those responsible for PIT learning center's operation was that the success of the center was limited only by lack of enough courseware.

INSTRUCTIONAL DEVELOPMENT

Instructional courseware for the Air Training Command's various Flying Training learning centers originates from one of three sources:

- It can be produced by the local learning center staff.
- It can be produced by another Flying Training Learning Center and copies provided to each learning center.
- It can be produced by or at the request of the Learning Center Support Division (LCSD).

In the case of the PIT learning center, courseware comes from all three of the sources listed above, however all materials which are in support of specific PIT objectives is produced by the LCSD at Randolph.

The development cycle for courseware is based on the requirements of Air Force Manual (AFM) 50-2. "Instructional Systems Development" however the impetus and success for courseware development rests with the instructor pilots who are the subject matter experts/course writers at each learning center. It is the enthusiasm and talent of those individuals which determines the success or failure of the courseware development efforts at each learning center.

COURSEWARE PRODUCTION

Origination of courseware elements - photography, graphic script, narration, etc., is the responsibility of the originating learning center; this means that local support is required by each learning center. Once the local learning center has compiled a master copy of its presentation it forwards the master to the Learning Center Support Division for professional narration services, the addition of "stock" or difficult-to-obtain images and duplication services. Duplication of audio materials is performed by LCSD, while photographic duplication is handled by Randolph's base photo service.

MAINTENANCE PHILOSOPHY

Courseware maintenance is the responsibility of the instructional development personnel assigned to the local learning center; they can and do update those segments of the instructional presentations. All changes are supposed to be coordinated through LCSD, but it would appear that is not necessarily what is occuring.

Equipment maintenance is provided to each learning center by the Training Equipment or Audio-Visual Services branches at each base.

WILLIAMS AIR FORCE BASE
Chandler, Arizona
(Undergraduate Pilot Training Learning Centers)

Within the Undergraduate Pilot Training (UPT) program at Williams, AFB, two learning centers are in use. Physically and functionally similar, these learning centers are intended to support the flying training (as opposed to the academic) portion of the UPT program. The flying training portion of UPT is divided into two major segments distinguished by the aircraft type in which training is done, thus T-37 and T-38 training.

Each of the UPT Learning Centers are located adjacent to their respective flight lines. At any given time, each segment of the UPT program has 200-300 students who could make use of the learning center's capabilities. Each center is furnished with study carrels capable of accommodating two students simultaneously. Four different types of carrels are present in each center. These are:

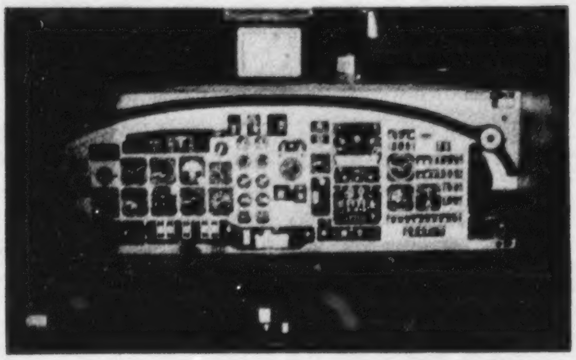
- Cockpit mockup
- Video
- Audio-Visual
- Evaluation

Students use the Learning Centers on both a mandatory and voluntary basis. Mandatory use involves the specification that a particular instructional package be completed prior to particular training flight. The center is open on space available basis to those students whiching to review any available material.

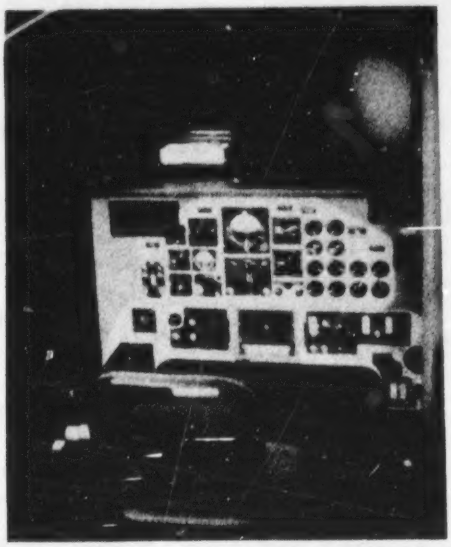
COURSEWARE DEVELOPMENT

Instructional and software development support for the learning centers has been provided from several sources. The primary source of support is the Learning Center Production Support Unit at Williams. This organization was formed specifically to develop sound/slide instructional packages for use in the T-37/T-38 programs at Williams. All phases of the instructional development process except the duplication of finished materials are accomplished at Williams, AFB. The production of multiple copies of a given instructional package is handled by the Learning Center Support Division at Randolph AFB (see page 35). The Learning Center Support Division at Randolph AFB also provides to the Williams Learning Centers sound/slide instructional packages developed at other UPT bases (Sheppard, Randolph, etc.).

The Williams Learning Centers presently have only enough instructional packages available to support 2-3 weeks of flying training in each of the two programs. The centers are judged to be efficient instructional tools, but their full potential is seen as being handicapped by the lack of available instructional software and an adequate program for the development of that software.

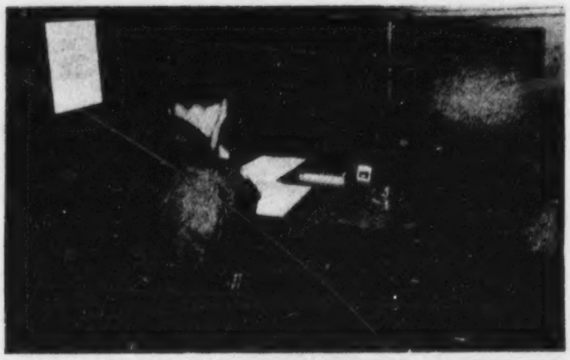


Two-men study carrel designed to represent a T-37 cockpit configuration. Touch-tone panel in the center of the carrel allows the student to select one of a number of procedural lessons which combine audio with information available from the mockup of the aircrafts instrument panel.

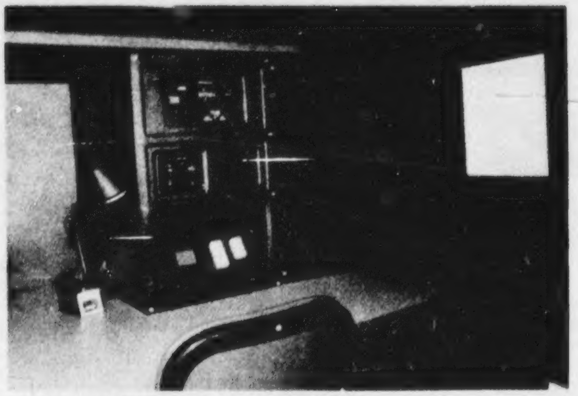


Student carrel designed to represent a T-38 cockpit. The display screen occupying the upper right hand portion of the carrel is synchronized sound/slide presentation system used to present both procedural and flight information.

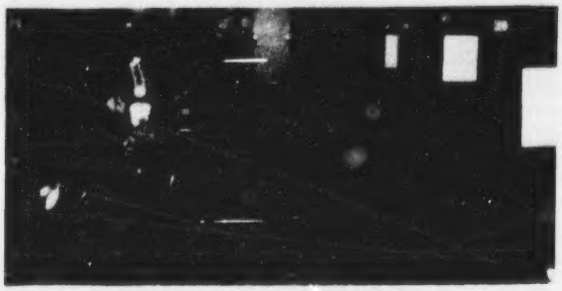
This two men study carrel is equipped with a nine-inch monochrome video monitor and is tied into the learning centers dial-access audio-video system via the touch-tone panel in the carrel. The carrel can also house the Super-8 mm film cartridge projector shown in this photo.



A typical two-men study carrel equipped with a sound/slide presentation system.



A study carrel equipped with a sound/slide presentation system and a multiple choice examination system.



Study carrel layout in the T-37 learning center.

Audio and video playblock decks for the dial-access distribution system.

COURSEWARE PRODUCTION

The Learning Center Production Support Unit at Williams presently has two (subject matter expert) writers, one for T-37 instructional materials and one for the T-38 training program. The materials developed for both programs consist of approximately 60% sound/slide and 40% Super - 8. The Super - 8 materials available were produced by AVIS. The staff of the Production Unit at Williams has produced their own art, audio, and still photographic materials. The base photo lab has done the necessary processing for the unit.

MAINTENANCE PHILOSOPHY

The Production support unit is responsible for the maintenance updating and necessary modification of the course software.

Hardware maintenance is handled by technicians assigned to the flight line Learning Centers, with outside (contractor, or base support) assistance as required.

FORT BENNING GA
US Army Infantry School
(Individual Learning Center)

The United States Army Infantry School (USAIS) conducts basic and advanced courses for Army infantry officers. The subject matter of these courses is broken into the following categories: 50% military subjects (tactics, weapons, etc.), 5% guest speakers, 5% decision making/problem solution and 40% enrichment and electives. This training is provided by the following means: 95% group-paced lectures and conferences, 2-3% self-paced instruction using programmed texts, and approximately 1% (22 hours) via CAI.

To improve the effectiveness of training, the Infantry School has experimented with a mechanized classroom using EDEX responder systems tied into 35 mm slides and Super - 8 mm motion pictures, and audio system within each of two classrooms. Achieving a certain degree of improvement through this approach, but realizing that they were still bound by the limits inherent to group based instruction, the Infantry School has made some initial steps in the direction of individualized instruction.

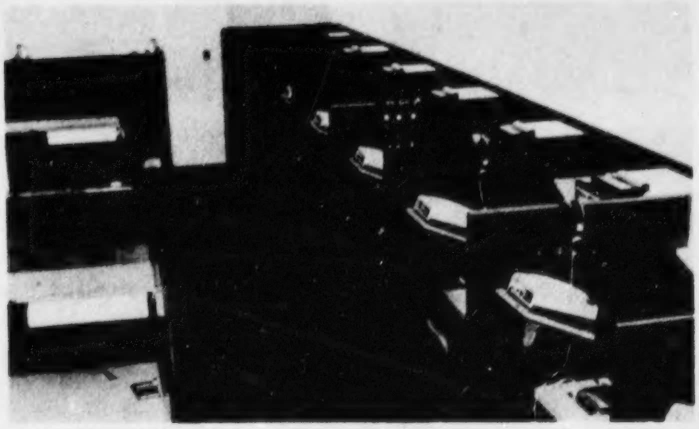
The Infantry School has designed and developed the Individual Learning Center. The center is presently equipped with 47 individual carrels (it will be expanded to 131 in the new facility which was scheduled to be operational by November, 1972). Each carrel is equipped to support sound/slide, audio only, Super - 8 mm motion pictures and video (from U-matic format cassette systems) presentations.

The Individual Learning Center is not yet an integral part of the Infantry School curriculum. It is sometimes used for remedial assignments, but its primary use is as voluntarily selected supplement to the regular course of instruction. It is anticipated that the opening of the expanded facility will allow the Infantry School to schedule the use of the Learning Center as an integral part of the Infantry Officer courses.

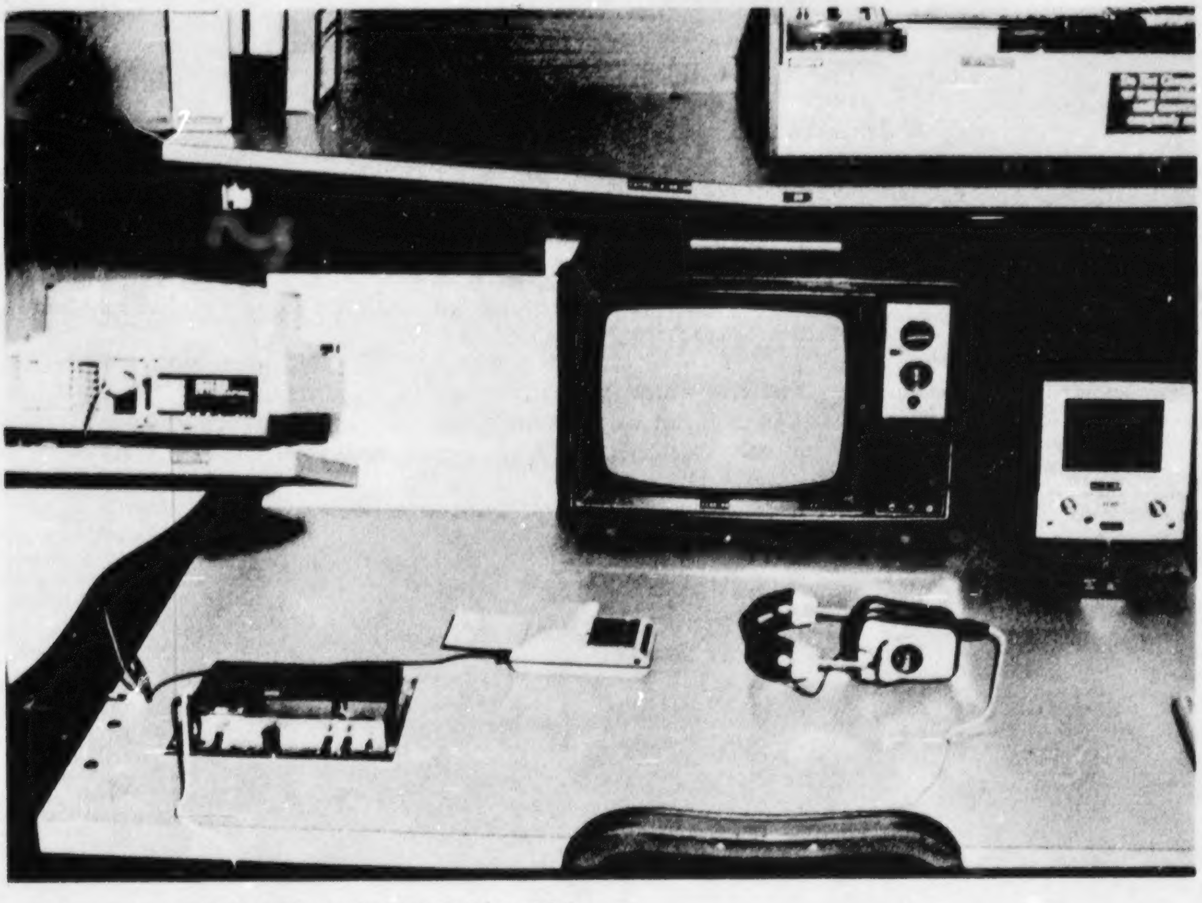
COURSEWARE DEVELOPMENT

Responsibility for courseware development at the Infantry School is assigned to the instructor staff. The instructional strategy and methods to be used are the responsibility of the Instructional Methods Division. The instructors, under supervision and with assistance from the appropriate subject matter experts, are responsible for the preparation of programmed texts, development of training narratives, and determination of additional training materials (audio/visual, sound-slide) requirements for their area of responsibility.

The instructional staff has available to them the school's TV production facilities and sound production facilities, in addition to a photographic and art group.



Study carrel configuration in the Infantry Schools Learning Center.



Typical equipment configuration for the study carrels, left to right:

- 35 mm slide projector
- 3/4" U-matic format video cassette player
- Super-8 mm film cartridge device
- 12" color video monitor
- Synchronized audio cassette deck with headset and responder.

COURSEWARE PRODUCTION

Based on data gathered during the survey visit, the courseware production process is as follows:

a) The instructors, working with their subject matter expert, develop the appropriate program text and narrative materials outlining the media requirements.

b) The developed materials requirements are reviewed by the Instructional Methods Division and the Instructional Innovations Branch.

c) All required materials production is then coordinated with the TV production operation and sound production facility personnel or the staff members of the photographic and art groups.

d) All materials, with the exception of Super 8 mm - which is contracted out, are produced by these school staff members. The processing of 35 mm slides is handled outside the school by a base support photo processing laboratory.

MAINTENANCE PHILOSOPHY

All courseware maintenance and revision is handled by the school staff, except for Super-8 materials, which the contracted agency revises based upon inputs from the school staff.

The newness of the schools multi-media equipment has not lead to the establishment of a firm quality control function at this time. They do have one maintenance technician who is responsible for the CAI system. Maintenance of the EDEX responder system is presently handled by the base Communications - Electronics Group.

FORT MONMOUTH NJ
US Army Signal Center and School

The U. S. Army Signal School was selected as a member of our survey population because its emphasis on the application of innovative instructional techniques to a broad spectrum of technical training programs. Three aspects of the instructional program at the school were of particular interest; these were the:

- Computer Assisted Instruction Division
- COBET Program
- And the School's Instructional Television System.

The Signal School at Fort Monmouth is a large multi-branched organization encompassing the myraid of instructional and support divisions characteristic of military training centers. The three aspects of the instructional program at the school which are of interest here.

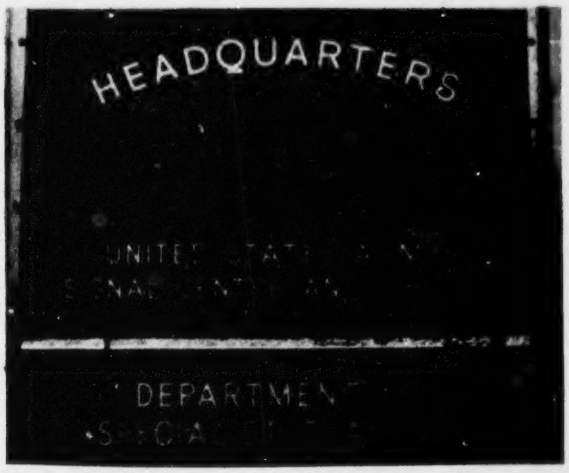
Computer Assisted Instruction Division

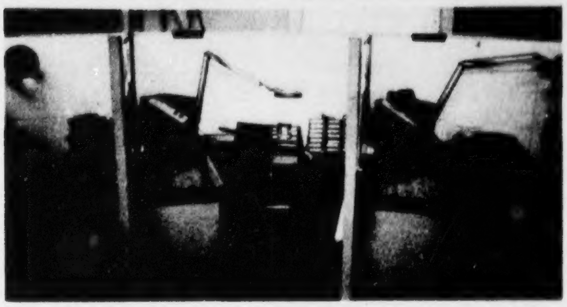
The Computer Assisted Instruction (CAI) Division has recently completed a series of evaluations of CAI in teaching basic electronics in the U. S. Army. At the time of our visit the research program had been completed and the system was no longer in operation; however, the results of the project are significant and are summarized below:

The CAI program at Fort Monmouth was oriented toward development use and evaluation in an operational environment; it was not designed to investigate the suitability of specific hardware or software, but rather to demonstrate and test the utility of CAI for this type of training.

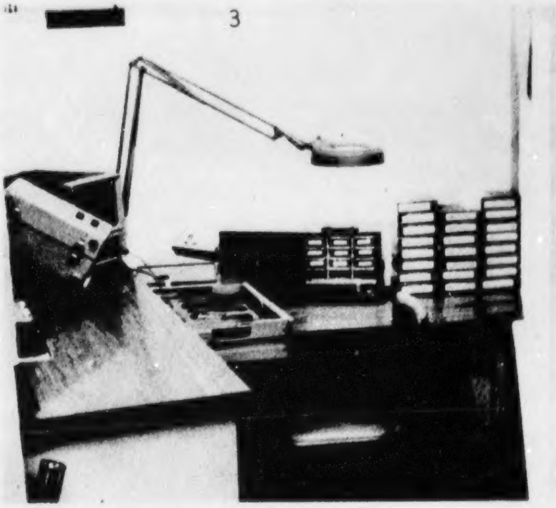
The hardware system used in the project was the IBM 1500 system operating through IBM 1510 Display Consoles and IBM 1512 Image Projectors. The software system used was the IBM Coursewriter language operating in a tutorial mode.

The subject matter of the CAI programs encompassed the first four weeks of Army basic electronics training. The results of the research program are phrased in terms of the comparative results achieved by equally matched groups instructed using CAI and "Conventional Instruction" (CI). The criteria applied in the evaluation of CAI performance were of five types:

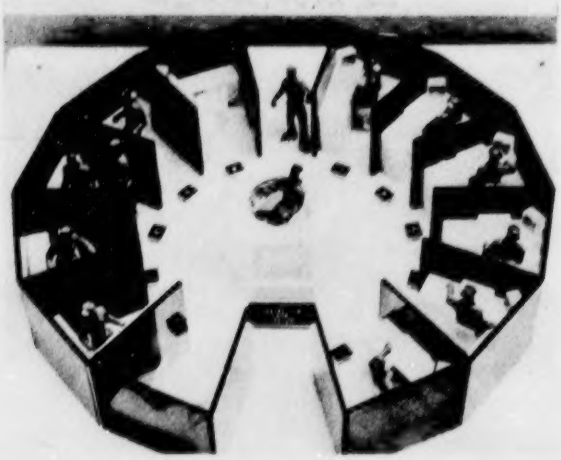




Student positions in the prototype COBET instructional facility.

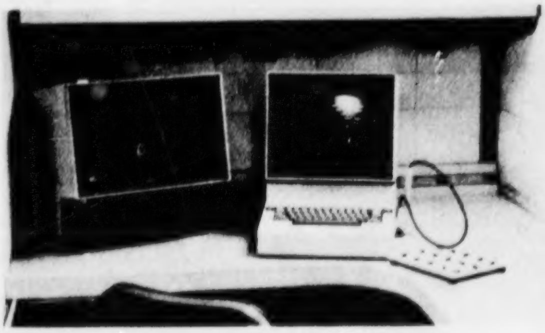


Individual student carrel in the COBET facility. The instructional sequences are provided by a super-8 mm filmstrip presentation device (left hand corner).



Model of the study carrel configuration developed for the COBET program.

Relationship of Student/Instructor positions in the COBET facility.



Student position in the schools CAI system.

I. Basic Achievement Criteria

A. Comparison of CAI/CI on test achievement (written/performance) and time to complete Weeks 1-4 (102 hrs)

B. Comparison of 3 aptitude levels (hi/mid/lo) on the above criteria (para 1-B);

C. Analysis of the interaction of study groups with aptitude levels on the above criteria (para I-B);

II. Follow-Up Achievement Criteria

D. Comparison of CAI/CI on 2 weeks of CI training for both groups on the above criteria (para I-B);

III. Equal vs Unequal Size Groups

E. Parametic comparison of equal size (matched) with unequal size ("as is ") group performance on the above criteria (para I-B);

IV. Attrition Incidence

F. Comparison of CAI/CI, at 3 aptitude levels (hi/mid/lo). on academic attrition rates;

V. Attitude Toward CAI

G. Assessment of Student attitudes toward CAI. [2]

The results of the evaluation indicate that CAI is as effective as GI in teaching basic electronics and results in approximately a 35% savings in training time. Specifically, the results of the evaluation can be summarized as follows:

1. CAI, across aptitude levels, is as effective or better than CI with respect to the generally employed criteria of student achievement; written/performance tests and attrition rate.

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[2] Longo, A. A. A Summative Evaluation of Computer Assisted Instruction in U. S. Army Basic Electronics Training. U. S. Continental Army Command Computer Assisted Instruction Project, Technical Report, 72-1, Fort Monmounth, New Jersey, May 1972.

2. CAI, across aptitude levels, has the capability to reduce training time to a significant degree relative to average CI completion time.

3. CAI students, on the average, are favorably disposed toward CAI.

4. The tutorial approach is a viable instructional method in the presentation of CAI materials in U. S. Army basic electronics training.

5. CAI is a viable instructional system within an operational Army training environment.

These results have been significant enough that the Army has begun to design an improved CAI system configuration. This system, with the addition of an on-line authoring capability, reduced response time, external control of audio and visual materials and simplified methods for imputting graphic materials to the system, will be used to extend the Army's research into CAI.

COBET Program

The acronym COBET refers to the Army's Common Basic Electronics Training Program. Begun in 1967 the COBET programs broad goal was stated as:

> " To devise for all ten Army schools where electronics are taught, a more effective method of teaching basic electronics and to develop a standard course of instruction that will prepare the student to begin any of the Army's 75 different electronic equipment repair courses.
>
> Specific objectives derived from this goal were: (1) to improve effectiveness and reduce the cost of training of electronic technicians (2) to reduce the time ratio between schooling and productive service to the Army; and (3) to embody these essentials in a complete training program that will be geared to the lowest practical aptitude level". [3]

The instructional strategy developed for COBET consists of five major points:

1. Be based upon a "learning by doing" principle; at least 75 percent of the student's time must be devoted to hands-on-equipment work.

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[3] Johnson, F. F. Jr., "Better Learning Management: COBET offers a Model", American Vocational Journal, 28-32, April 1972

2. Be designed to allow students to advance as rapidly as they can, each according to his own ability.

3. Include the skills and knowledge required to meet appropriate terminal performance objectives to be developed for COBET.

4. Be conducted with maximum support of multimedia, audiovisual training systems.

5. Culminate in tests of students ability to perform required tasks under specified conditions and within the terminal performance objective time and achievement standard." [4]

COBET resulted in the identification of several factors that have a direct bearing on this survey; the first of these was the projects identification of a requirement for a new physical environment to support and contain the strategies cited above and the development of a unique solution to that problem, the second factor was the design and development of new instructional devices tailored to the program's requirements, and the third factor was the development of a useful approach to instructional materials development.

The first of these factors - the physical environment - arose from the project teams identification of a distinct requirement for an instructional station which would house the student, the audio-visual presentation media and training equipment while providing required levels of privacy, acoustical and visual conditioning necessary to enhance individual study.

COBET's answer to these requirements is the 12-student circular carrel cluster shown in the accompanying photographs. The cluster is arranged in a 26-foot circle with a 3.5 foot opening facing the 6-foot-in-diameter instructor's position located in the center of the circle. Each carrel is 6 feet deep with a 6-foot long work bench at the rear of the carrel. The walls of each carrel are 5-1/2 feet high.

From their analysis of the training objectives to be met, the COBET team identified 45 common circuits which could be integrated into 10 individual electronic packages. Analysis of available electronic training equipment showed that none existed which met the requirements of the program, thus the COBET team designed and constructed the prototype devices. These devices are modular in nature and relate to each other and to the instructional materials such that there is a logical progression and relationship between each module of instruction and each training equipment module.

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[4] Johnson, F. F. Jr., "Better Learning Management: COBET offers a Model", American Vocational Journal, 28-32, April 1972.

The self-pacing requirement of COBET's instructional strategy almost demanded the use of some type of audiovisual media be used in the course. Analysis of the specific requirements of the material to be taught led the COBET team to select sound/filmstrip as the primary media in the carrel. Due to time pressures and staff limitations the COBET team used outside contractors for courseware development. One of the primary results of this effort was the identification of major communication problems between the COBET team and the courseware contractor particularly with respect to the communication of the graphic and visual requirements and suggestions of the COBET team. In order to overcome this gap the COBET team used video tape to develop prototype instructional materials or story ideas and presented these to the courseware developers. While this technique helped reduce the confusion level, the COBET team feels that remote development of courseware is not a satisfactory arrangement.

While evaluation of the COBET program is not completed, the initial results indicate that COBET students reach criterion levels more rapidly than those taught by more conventional methods; the system also seems to raise the performance level of low aptitude groups.

Instructional Television

The instructional television (ITV) system at Fort Monmouth is a 22-channel closed circuit cable television system designed to provide mass instruction to the entire signal school. The ITV system services 722 receivers throughout the school complex. The average instructional program broadcast over the system is 20 minutes in duration and is normally a pre-recorded tape or telecine transcription. The system logged 10,390 transmission hours in 1971. The ITV broadcast and production operation are designed, staffed and operated as a commercial television operation; the staff prides themselves on this aspect of the system and strives to maintain it.

Several aspects of the ITV system make it a desireable addition to this survey, this includes their recent conversion of one of their studios for color operations; their system for instructional productions (3 to 4 production per week, 180 completed in 1971 and a 2 week production time), and their replacement of the existing Telecine equipment with video cassettes.

INSTRUCTIONAL DEVELOPMENT/COURSEWARE PRODUCTION

All instructional programs at Fort Monmouth are in the process of being converted to objective-based instruction via the Army's "Systems Engineering" of instruction; identical to the Air Force's ISD Program, this process has not yet been completed. In the three programs described in the preceding paragraphs only the COBET and CAI program represent instruction tied to properly stated behavioral objectives.

FT RUCKER AL
Synthetic Flight Training System (SFTS)
USAAVNS, Learning Center
USAAVNS, Dept. of Maintenance Training

At Ft Rucker, three training/learning environments were visited. These included: (1) the SFTS, (2) the Aviation School Learning Center, and (3) the UH-1 Helicopter Maintenance Training Course.

(1) The present engineering development model of the Synthetic Flight Training System (SFTS) consists of four simulated UH-1H helicopter cockpits mounted on motion platforms with five-degree of freedom to provide motion cues, a third generation digital computer complex, and an instructor station. All training functions for each cockpit can be controlled by a single instructor through the computer, which is programmed to perform many of the repetitive operations traditionally assigned to the human instructor. Use of an advanced digital computer in the SFTS allowed for the inclusion of two innovative features. These are: (a) the adaptive training mode, wherein the level of difficulty of a particular lesson is automatically adjusted to the skill level of the trainee, and (b) the capability of automatically scoring the student's performance in relation to selected parameters. It is estimated that these features, in combination with the high level of fidelity to the helicopter being simulated, will result in a reduction of up to 45-hours flying time per student in the training program. The annual savings realized from this reduction in utilization of operational aircraft is expected to amortize the procurement cost of the SFTS in approximately three years.

(2) The US Army Aviation School (USAAVNS) Learning Center is staffed with instructors and equipped with individualized lesson material to assist student and/or rated Army aviators. Use of the center is on a voluntary basis, however, over 20,000 people have visited and used the center since it opened in January of 1971. These users have included flight students searching for off-duty help in a variety of subjects, instrument students primarily using the instrument training programs available at the center, and rated pilots reviewing for instrument rating renewals. Lessons available at the center fall under six major topic areas as follows:

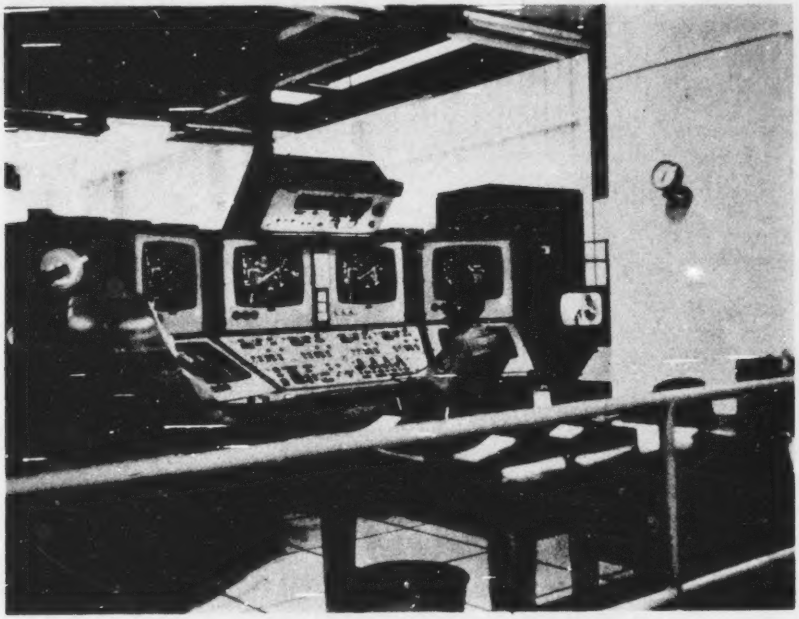
Air Traffic Control
Flight Lessons
Instrument Lessons
Aircraft Systems
Tactical Lessons
Miscellaneous

The media by which lessons are presented include printed handouts, Super 8 mm films, programmed texts, audio recordings, sound/slide sets, and videotapes.

(3) The UH-1 Helicopter Maintenance course is an individualized self-paced course (referred to as "Learner Controlled Instruction"). For each block (module) of instruction the student follows the "Student Performance Guide," which he uses in conjunction with a 35 mm slide projector and tape cassette and continue the lesson.

The original maintenance course was 231 hours. The present individualized self-paced course is designed for 200 hours with the average student completion time being 186 hours, for an average saving of 45 hours per student.

View of the Synthetic Flight Training System (SFTS) facility showing the four trainer stations with the instructor station located in the center.



View of the Instructor Station. Each display screen is presenting the data associated with a different trainer station. Controls and displays on the Instructors console allow him to monitor and control all four trainers simultaneously.

U. S. NAVAL TRAINING CENTER
Orlando, Florida
(Advanced Underseas Weapon School)

The Advanced Undersea Weapon School is a formal school within the Naval Schools Command. It provides training to naval enlisted and officer personnel (domestic and foreign) in the employment, operation and maintenance of undersea weapon systems. Enlisted training at the school is in two primary areas: Torpedo Technician Training and Test Equipment Technician Training.

The Torpedo Technician course is an entry level course ("A" School) which trains newly enlisted personnel in the handling, checkout and loading of torpedos. The course is conducted making extensive use of programmed text materials, hands-on training on training equipment and suitably modified torpedos, and also as conventional lecture/demonstration instruction in responder equipped classrooms. Course duration is a function of the weapon system the student is being trained on.

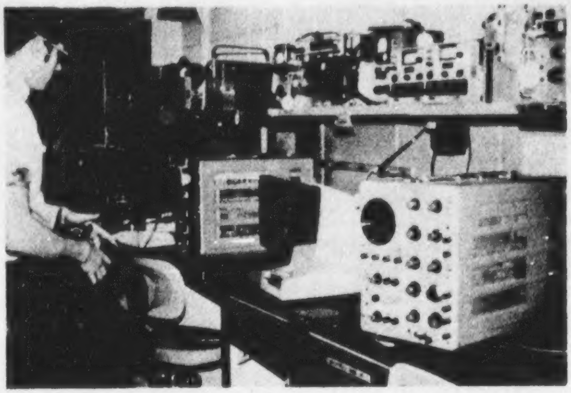
The Test Equipment Technicians course is an advanced training course ("B" School) intended for personnel with one or more years of operational experience in jobs involving underwater, or similar weapon system experience. Students are trained in the operation and maintenance of the test and checkout equipment used in the maintenance of undersea weapons. The course was originally a 16-week program of lecture/demonstrations, and technical manual training. This training course has been redesigned as individualized study and the entire program has been converted to support the instructional process. Instruction is provided using programmed texts and Super - 8 mm filmstrips (PIP System) both in individual carrels and in conjunction with the actual hardware and with specially developed training devices (specifically designed to train electronic logic functioning and operation).

The course is divided into approximately eighty percent laboratory exercises and twenty percent individual study. The Norelco PIP system is used to support almost all individual study exercises. The motion capability of PIP is used less than 5% of the time. While some use is made of the PIP system to support laboratory exercises, its primary application is to augment the students workbook exercises.

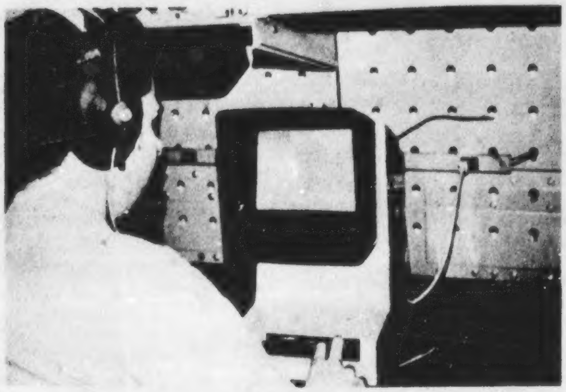
The effectiveness of the learning center concept in this application is evident in the reduction in average course completion time from 16 to 14 weeks. The range of completion times in this program was among the widest noted in the survey with the maximum time being 18 weeks and the minimum 8 weeks.

Criterion test performance indicate that students have been averaging 98% in the redesigned course.

Reports from the operational commands indicate graduates from this program are better qualified than those produced by the previous program.

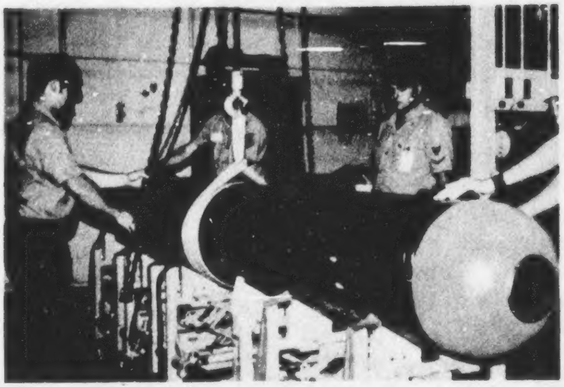


Test Equipment Technicians Course Training Laboratory showing test equipment and bench use of PIP System.



PIP System being used for laboratory circuit theory/troubleshooting training.

Student receiving instructor consultation in a study carrel configured with the PIP System.



Torpedo Technician training session using actual hardware for hands-on experience.

COURSEWARE DEVELOPMENT

All training publications and materials, except Ordnance Systems Manuals, are developed internally, including all Programmed Texts. Films (Super 8), slides, and TV tapes are also done locally wherever possible using the assistance of base support groups.

COURSEWARE PRODUCTION

Original materials for the school were produced and provided under contract by Sperry-Gyro Scope and A-C Spark Plug. At the present time, the staff instructors determine their courseware needs and the instructional techniques to be used. The Training Support Branch designs the courses and submits the Training Plan to CNTECH, Memphis for approval, prior to the initiation of materials production. Instructional materials are developed by the instructional staff in conjunction with the school and on-base production personnel.

MAINTENANCE PHILOSOPHY

All courseware and hardware maintenance is the responsibility of the school staff and is performed by them whenever possible. Base support is available for those hardware problems that are beyond staff capabilities.

U. S. NAVAL TRAINING CENTER
San Diego, California
(Basic Electrical & Electronics School)

The Basic Electricity and Electronics (BE & E) Class "A" School at the Naval Training Center, San Diego is a preparatory school for advanced schools in the electrical/electronic field. The course of instruction at the BE & E School can be characterized as individually paced and individually prescribed instruction based on carefully structured and well stated behavioral objectives. Diagnosis and prescription are both student and instructor administered: within any module of instruction the student controls both the means and pace of his instruction; progress from module to module is monitored and guided by the instructor/learning supervisor. Instruction is provided by three levels of textual presentation and by sound/slide and Super - 8 mm sequences. The textual material consists of three different presentations of the same content, the sound/slide and motion picture sequences are parallel to the textual presentations as well.

The conversion of the BE & E "A" School to individually paced instruction has resulted in an average 1/3 reduction in training time (from 32 training days to 20 training days) for the 6,000 students who have gone through the course. Attrition rate has dropped from 19 to 8 percent. Cost savings, estimated on the basis of $50 per week per student for the time saved, have offset both the developmental and operational costs of this program.

Mechanization and facilities requirements for the program are relatively straight forward-dry carrels, AV carrels and a separate testing area.

COURSEWARE DEVELOPMENT

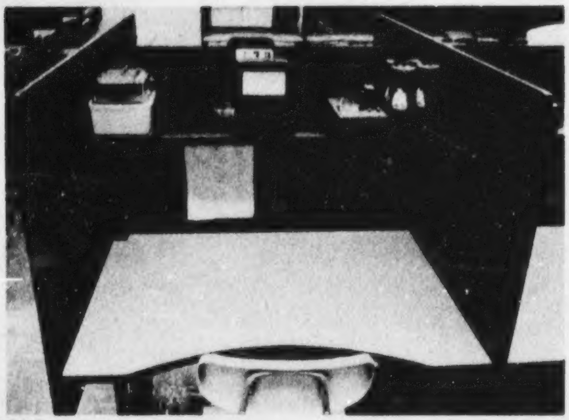
The bulk of the instructional materials being used in the BE & E course were developed by Philco-Ford under a Navy contract. Since their introduction they have been modified to a certain extent by the instructional staff. Arising from the training centers experience with this course and consonant with Navys adoption of a systematic approach to the design of instruction, the Communications and Electronic School has established an Individual Learning Design Group (ILDG) which has the responsibility of indoctrinating and training instructional personnel in other courses in the arts and techniques of courseware development.

COURSEWARE PRODUCTION

All instructional materials are procured through regular Navy procurement channels.

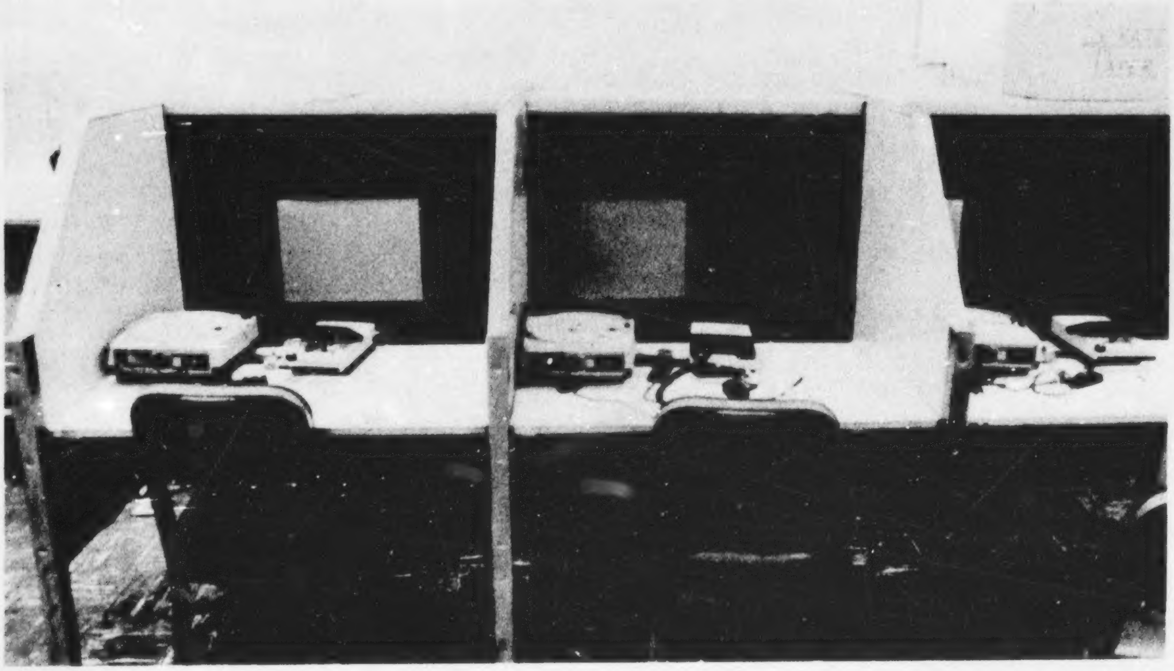
MAINTENANCE PHILOSOPHY

Courseware maintenance is the responsibility of the instructional staff; however, since all materials except the examination devices and the exams themselves are procured in quantity on an annual basis, courseware maintenance is not a dynamic process. Equipment maintenance is provided by the instructional staff or by base support activities.



BE&E study carrel configuration, equipment and components on shelf are used during the hands-on exercises which are required throughout the course.

BE&E students using workbooks and programmed texts.



Sound/slide presentations are used to supplement the material presented in the textual materials. The audio presentations contain audible cues which direct the student to change the slide.

The examination laboratory for the BE&E course. At the completion of each module of instruction the student proceeds to this room and requests the appropriate test from the duty instructor, he then proceeds to the corresponding examination station where he performs the hands-on tasks that comprise the examination.

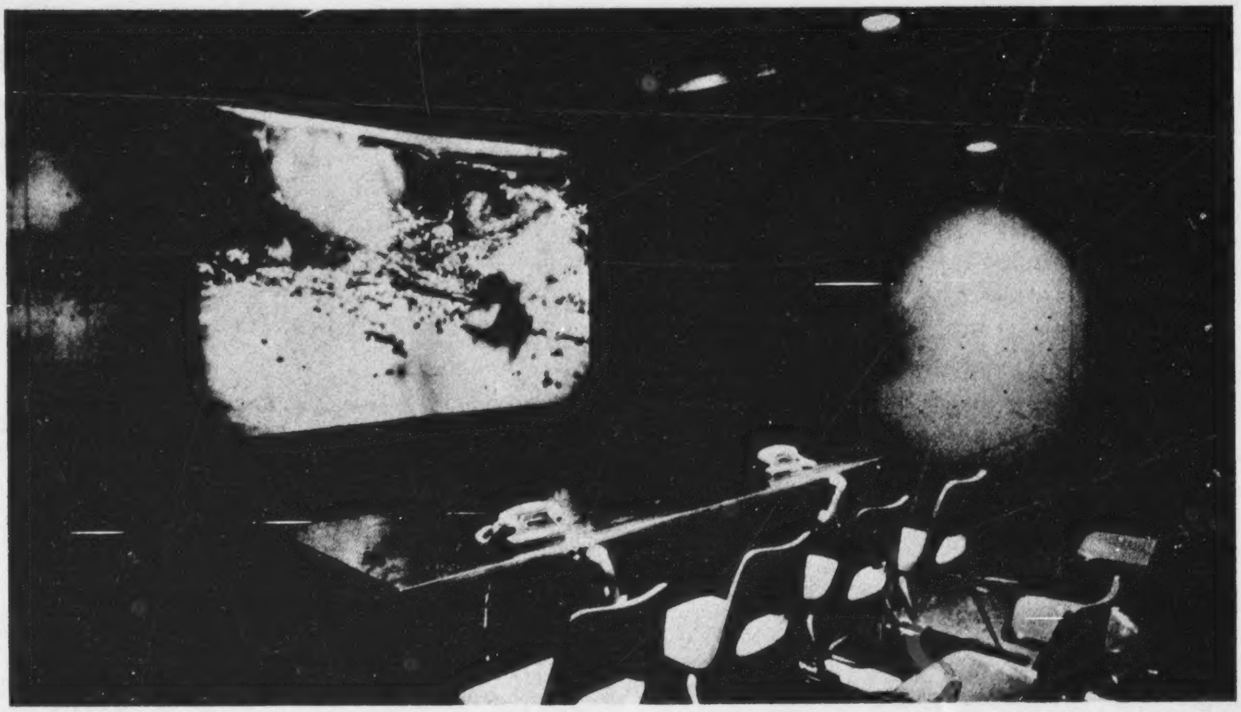
U. S. FOREST SERVICE
Marana, Arizona
(National Fire Training Center)

The National Fire Training Center was established at Marana, Arizona early in 1967 by the Division of Fire Management, U. S. Forest Service. The primary goal of the center is to aid the Division of Fire Management in the preparation for the conduct of advanced servicewide fire training courses held at the center. Courses presented cover such areas as Fire Prevention, Law Enforcement, and Air Operations. There are approximately 60 to 100 students at the center at a time, with 25 students to a class. Whenever possible, st students are broken into smaller work groups. Courses are conducted during the winter "off- season" months. Primary instructional methods used are printed materials, slide/tape packages, some CCTV and the Mark 1 Command Fire Simulator. The command system fire simulator is the most complex and unique device in use at the center. It is designed primarily for advanced fire fighting students, those responsible for organizing and directing fire suppression activities. With the aid of built-in projectors, the fire simulator operator projects a forest scene provided by a 35mm slide onto a rear projection screen. With additional projectors (4) and the accompanying equipment and controls the instructor can initiate and supervise moving images of a fire, smoke and other environmental conditions onto the same screen. With other adjustments of the controls, the operator can indicate changes in wind direction and fire behavior in order to present a "realistic" challenge to the trainee fire boss. An audio system is used in conjunction with the projection system which can provide sound effects of efforts such as radio traffic, aircraft support, etc. The (trainee) fire boss's job is to direct fire suppression activities. A critique held after presentation of each fire problem provides feedback to the trainee as to his performance. An EDEX student response system is used with the simulator during a fire exercise. The response system is used to provide active participation by an additional (observer) group of trainees in addition to the trainee fire team. By means of cues and questions provided in synchronization with the fire problem the trainees functioning as observers become active participants in each fire problem.

The pacing of instruction at the center could be defined as being lockstep since students do enter and exit as a class; however, within the time packing imposed by fixed entry and exit dates, the students are permitted a significant amount of latitude in their approach to the time spent on any phase of their training.

COURSEWARE DEVELOPMENT

Some courseware preparation is performed at the school by staff members, however, production of the majority of their material, such as



View of the Command Fire Simulator in Operation

Students functioning as Fire Bosses during a Simulator Exercise programmed texts, sound/slide programs, and films are contracted to outside educational/instructional development organizations.

COURSEWARE PRODUCTION

It is the responsibility of the school staff to define and outline the requirements for the course(s) they want to present. As stated above, most production is then contracted out based upon the developed requirements.

MAINTENANCE PHILOSOPHY

Maintenance of the materials developed by staff members is handled at the school. Those materials that are contractor developed are modified a updated under additional contractual efforts.

SOUTHERN CALIFORNIA REGIONAL OCCUPATIONAL CENTER
Torrance, California

The Southern California Regional Occupational Center (SCROC) is a public education institution which is a regional tax supported school district superimposed over and serving six other public high school districts. It was established to provide valid occupational training to a population consisting of 12th grade high school students wishing to acquire marketable skills, high school graduates desiring specific occupational training and adults interested in acquiring new or improved occupational skills. The center serves approximately 4,000 students per 15 hour day, 6 days per week. All training programs have been developed in consultation with the industries in the communities served by SROC; this consultation has extended to the provision of financial support to develop specific courses. The importance of this relationship is the emphasis on establishing and maintaining continuity between industry's entry level requirements, the tools and techniques that are presently employed in the real world, and the training provided by SCROC. This has been done deliberately with a single goal in mind-providing the student with a marketable skill.

The existing curriculum at SCROC is the result of a comprehensive instructional systems development program instituted and carried out by the Instructional Media and Systems Division of the center. Under this program:

1) Potential occupational specialities were identified through analysis and consultation with industry.

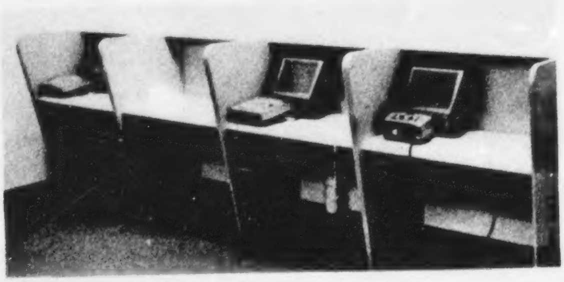
2) An analysis of the skills required for entry-level positions in these specialities resulted in the establishment of the limits, constraints and general skills for each course of instruction.

3) Each skill or general task was further analyzed to establish Terminal Performance Objectives (T. P. O. 's) detailing a measurable outcome of the instructional process. For approximately 50% of the instructional program provided at SCROC, a fourth step - the conversions of these T. P. O. 's into self-contained Audio-Visual Modules - has been performed.

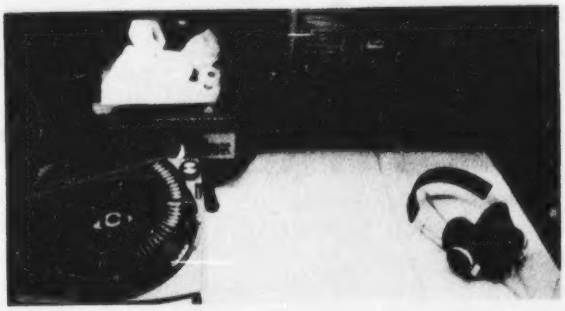
The center has been successful in achieving the goals for which it was established: 80% of its graduates are successfully employed, it has less than a 1% dropout rate, and the instructor turnover is low. The success of the specific instructional strategies employed, and the effectiveness of the individualized instructional materials developed by the center, is less evident and would require more intensive study than this survey permitted.

Audio-visual presentation system developed by SCROC for use in laboratories, shops and other hands-on training environments. Mounted on a standard projection cost the system consists of a 35 mm slide projection, rear projection screen, audio cassette deck capable of cueing the slide projector and a wireless headset. The antenna for the wireless headset is concealed behind the front panel on the cart.

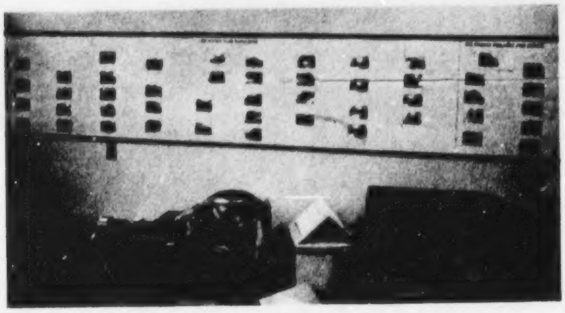
The centers sound/slide library.

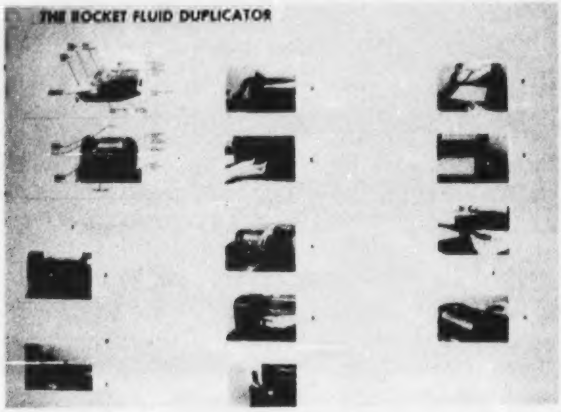


Learning center carrel configuration.



Typical study carrel configuration: 35 mm slide projector, synchronized audio cassette deck, rear projection screen, headsets and footswitch control for the cassette deck.

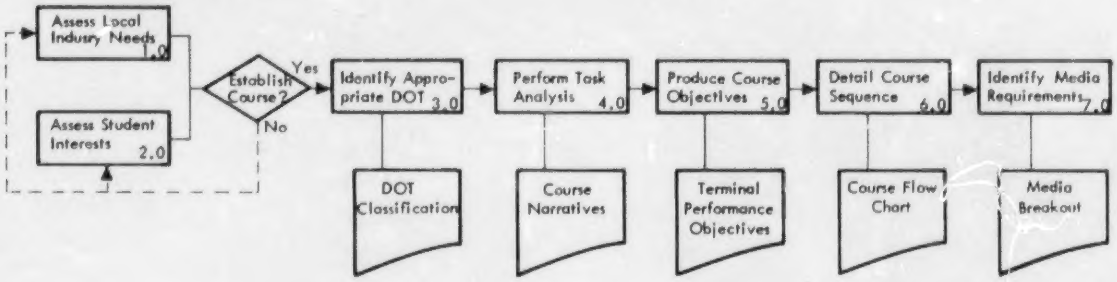




Step-by-step procedures for equipment operation presented via a photo story board placed above the equipment. (4 x 5 black and white illustrations, typed text on 3 x 5 cards mounted on particle board).

INSTRUCTIONAL DEVELOPMENT

The instructional development process employed at SCROC is shown in the figure below:


Assess Local Industry Needs 1.0
Assess Student Interests 2.0
Establish Course?
Yes
No
Identify Appropriate DOT 3.0
Perform Task Analysis 4.0
Produce Course Objectives 5.0
Detail Course Sequence 6.0
Identify Media Requirements 7.0
DOT Classification
Course Narratives
Terminal Performance Objectives
Course Flow Chart
Media Breakout

SCROC COURSE ANALYSIS PROCESS

Figure 1

This process has been extended only through the analysis phase with any consistency. For the actual development of the instructional material the responsibility is shifted to the individual instructor; he is provided with the objectives and he is required to design his instruction in accordance with them.

Conversion of the T.P.O.'s and Media requirements into self-contained instructional packages is the responsibility of the Centers Instructional Media and Systems Division. This activity has designed and prepared approximately 425 modules (approx. 20-30 min. duration) of instruction, which represents about 45% of the instructional modules in the center's program. All of these modules have been validated and are available for use.

COURSEWARE PRODUCTION

For those instructional modules designated for mediation, the following process is employed:

- The instructor/subject matter expert amplifies, on an as required basis, the T.P.O.'s for the module.

- The T. P. O. 's and any amplifying data is provided to an individual in the Instructional Media and Systems Division. This individual acts as the broker or account executive between the instructor and all production services.

- Script development is contracted for on a per-script basis, either to a subject matter expert or to a writer who has demonstrated he can work with the center's subject matter expert in a given field.

- Script content is validated and visuals are prescribed and designed by the writer, subject matter expert and Media Specialist.

- Production of modules was initially vended, with some prototyping done in-house; however, due to decreasing workload at the center and dissatisfaction with the results of contracted production efforts, production efforts are being performed by the center's Instructional Media and Systems Division Staff. Instructional modules developed to date are primarily sound/slide presentation, with some filmstrips and Super-8 film loops having been developed early in the program.

- All processing and duplication of photographic material is handled by commercial laboratories. Duplication of audio materials is done at the center.

MAINTENANCE PHILOSOPHY

Equipment maintenance of the routine type is carried out by Instructional Media and Systems Division personnel; more extensive maintenance is handled by commercial services.

The maintenance of the instructional content and courseware is the responsibility of the instructor and the Instructional Media and Systems Division. Continuous liaison is maintained with industry to obtain feedback on the validity and currency of the instructional programs as a whole; as the job market changes or the requirements of of specific industries vary, new courses may be created, and old courses modified or dropped. Within a given course it is the instructor's responsibility to insure that the students master the T. P. O. 's. If this requires changes in the instructional modules, then it is the instructor's responsibility to see that the Instructional Media and Systems Division is made aware of this requirement. The courseware maintenance process is identical to the courseware development process.

MARITIME INSTITUTE OF TECHNOLOGY
AND
GRADUATE STUDIES
Linthicum Heights, Maryland

The Maritime Institute of Technology and Graduate Studies is the focus and physical manifestation of a unique concept in professional technical training. The Institute is the instructional/training arm of the International Organization of Masters, Mates and Pilots. It is supported by that organization and by the 197 U.S. flag shipping companies that employ members of the IOMM & P.

The IOMM & P began in 1967 a program called the Masters, Mates and Pilots, Maritime Advancement, Training Education and Safety (MATES) Program. This program is designed "to educate and train the Masters, Mates, and Pilots of the American Merchant Marine to completely adapt to and master innovations in Marine design, function, structure and technology." 1 In order to foster this kind of technological advancement and improved capability on the part of its members, the IOMM & P conducted an intensive study that determined both the kinds of training they should provide and the methods available for conducting that kind of training. Out of the study grew the concept and plans for the Maritime Institute of Technology and Graduate studies.

The Institute presently offers three study programs: Collison Avoidance Radar and Navigation, Cargo Operations Training and Automated Ship Control Systems. Each of these courses is approximately 30 days in duration, with a new class beginning each month. Students for these courses are all licensed and experienced masters, mates or pilots who elect to attend the institute during their vacation periods. These programs are taught via a mix of lecture/demonstration, self-study and hands-on exercises. The Institute's focus is presently on the unique training advantages offered by its three advanced simulators. The institute staff and students feel that a large percentage of the effectiveness of their training is due to the availability and fidelity of the hands-on training experience provided by these simulators.

The three simulators were designed, built, installed and are supported by the Link Division of The Singer Company. The three simulators are:

- The Collision Avoidance Radar Simulator - designed to train Licensed Deck Officers in the comprehensive use of radar for collision avoidance and piloting. It provides hands-on training in shiphandling, radar interpretation, including use of the radar to pilot, a ship through a congested area and the use of the radar to safely navigate with respect to other ships.

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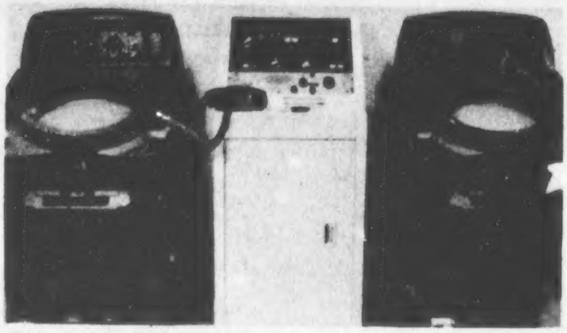
1. Excerpt from the address of Captain Thomas F. O'Callaghan, International President, IOMM & P at the Opening Day ceremonies of the Marine Institute of Technology and Graduate Studies.

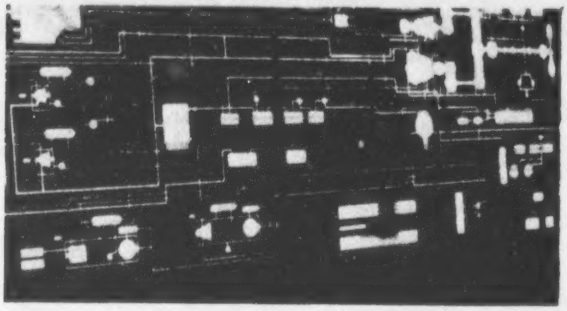
MARITIME INSTITUTE OF TECHNOLOGY
AND GRADUATE STUDIES



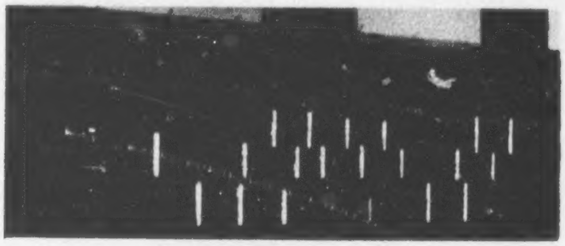
Students position (1 of 8) in the Collision Avoidance Radar Trainer. The two radar scopes provide different views (relative and absolute) of the same situation. The cubicle is designed to resemble a part of the bridge aboard a contemporary merchant ship.

Instructors station for the Collision Avoidance Radar Trainer.

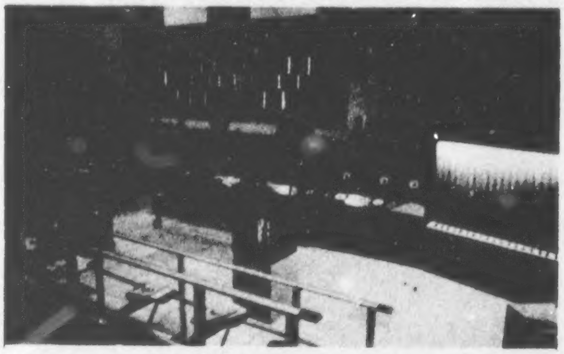
Bridge Console (center, foreground) and Engine room consoles in the Automated Bridge Console Trainer.



System status display board located above the Engine room consoles in the Automated Bridge Control Trainer.



System status display board for the Liquid Cargo Operations Trainer.



Liquid Cargo Operations Trainer; here as in the Automated Bridge console trainer students observe and participate in structured hands-on training. The consoles in the center are replicas of those aboard present day tankers. The status display and the video monitors indicate to the remaining students the nature and progress of the exercise.

- The Liquid Cargo Operations Trainer - designed to train individuals and groups in safe cargo-handling methods and emergency procedures. The simulator complex allows individual students to develop operational skills by practicing normal and emergency procedures; it facilitates group training by providing a large animated pictorial display board positioned above the simulated control panels. This display allows up to thirty students to monitor student performance or instructor demonstrations.

- The Automated Bridge Console Trainer - used to update and advance Licensed Deck Officer's knowledge of automated ship control systems, and to enhance his understanding of their capabilities and functions. By providing hands-on operating experience in a series of simulated exercises of increasing complexity, the officer's skills in evaluating and diagnosing the operation and malfunctions of modern ship propulsion systems are enhanced. Through the use of a large animated pictorial display, this trainer also facilitates group instruction as well as individual training.

INSTRUCTIONAL DEVELOPMENT

At the time of our visit, the Maritime Institute was using a mixture of contractor designed and instructor designed instructional packages. Instructional design and development was an integral part of the simulator design, development and production contracts let to Singer-Link. The contractors products constitute the majority of the instructional sequences presently used; however, as the instructional staff becomes more experienced with the requirements of their students and more familiar with the resources available to them, they are developing/modifying material and sequences to more closely fit the students and the institutes objectives.

The philosophy of the institute in the area of Instructional Development would seem to focus on the individual instructor.

COURSEWARE PRODUCTION

Classroom instruction is standard lecture/demonstration with overhead transparencies used as visual support. When specific instructional segments are revised or some form of mediation is selected, it is handled within the instructional staff. An illustrator is employed on a part-time basis to assist instructors in the preparation of visuals. All photographic work is handled by sources outside the Institute.

Modifications and changes to the simulation programs are of two types - those which are variations of established parameters and those which require the description and exercise of new parameters. For simulation problem changes of the first type, the instructor has control over some of the parameters in every problem sequence and he may alter these to increase or decrease problem complexity. Changes of the second type require assistance from the simulator manufacturer.

MAINTENANCE PHILOSOPHY

Courseware maintenance is the responsibility of the instructional staff. The addition of new courseware is presently being handled jointly by the institute staff and an outside contractor. Hardware maintenance is broken into two categories; routine maintenance is handled by the institute staff, malfunctions and breakdowns of other than routine nature are handled by services and organizations outside the institute.

AMERICAN AIRLINES
Flight Academy
Fort Worth, Texas

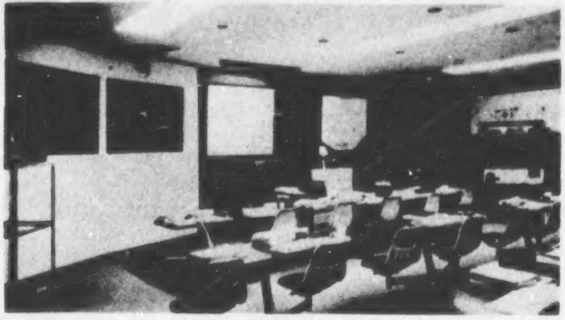
Since July 1971, all flight crew training activities for American Airlines have been carried out at the companies Flight Academy in Fort Worth, Texas. The center was established after an intensive analysis of the airlines existing and future training requirements which resulted in the following recommendations:

1. Physically centralize American's flight crew training at a city in the Southwestern United States.
2. Immediately appoint a Training Vice President within the Operations Department and delegate to him direct line authority overall flight deck crew training.
3. Establish cost-effective standards for all crew training programs on the basis of carefully selected training objectives.
4. Thoroughly revise each of the Company's training programs.
5. Develop a management control system for the training department.
    a. Precisely define training objectives and standards, including especially those that surpass FAA requirements.
    b. Develop management control systems based upon these objectives and standards
6. Begin immediately to build an instructor group with a capability for generating its own goals for American's training programs.
7. Base training building requirements on training needs - - (expressed in the study from which the recommendations are taken) - - and upon incremental building cost estimates (at various capacity levels) by an architect.

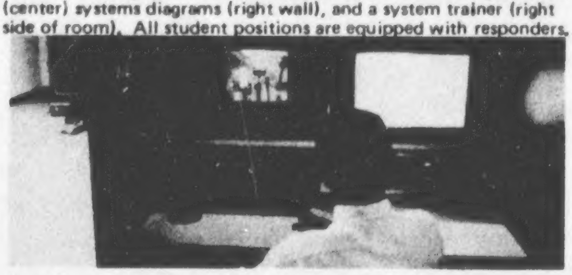
AMERICAN AIRLINES FLIGHT ACADEMY

American Airlines
Flight Academy

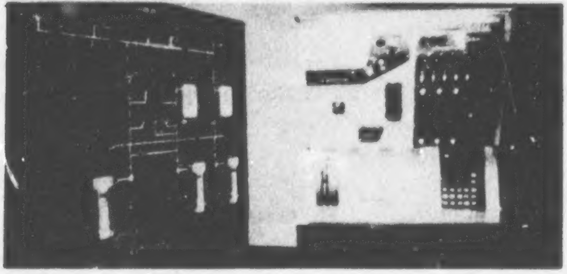
Entrance to the Flight Academy.

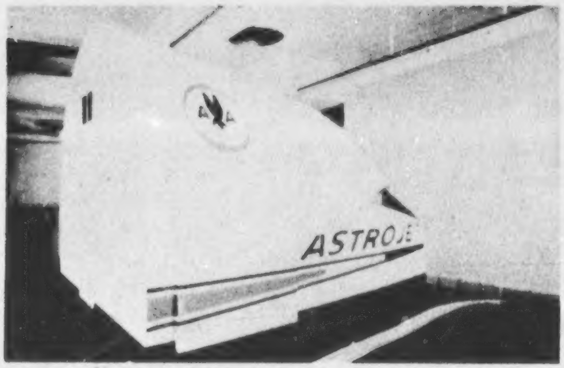


Standard classroom at the Flight Academy. This classroom and its counterparts are configured for programmed/lecture presentations. The room is equipped with two rear projection screens (left hand wall), front projection screen for use with overhead transparencies (center) systems diagrams (right wall), and a system trainer (right side of room). All student positions are equipped with responders.

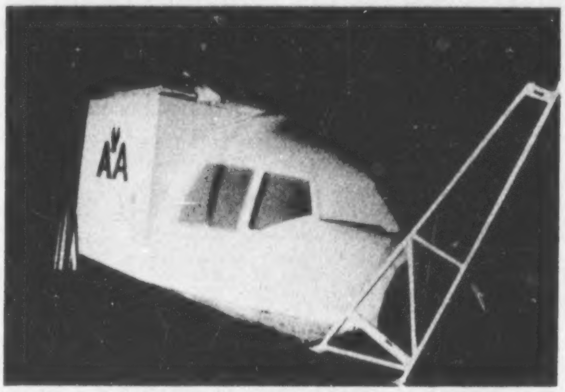


American Airlines designed and developed this study curved configuration for its DC-10 Flight Crew Training program. It is equipped with a color video monitor (left hand display) and a 35 mm slide rear screen presentation system (right side). Located underneath the slide presentation system is a panel containing a responder by which the students answers to question frames are obtained.

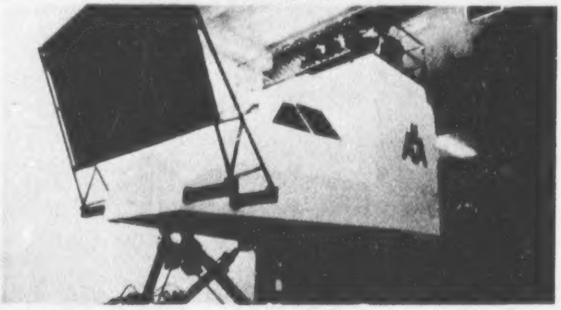




One of the several Cockpit Procedures Trainers (CPT's) used as integral element in the flight crew training program



American's DC-10 Flight Simulator with the presentation screen for the visual simulation system in place.



American's Boeing 747 Flight Simulator; the installation positioned in front of the cab is the screen for the visual simulation system. The television projectors for the visual system are located on the roof of the simulator cab.

DC-10 Systems Trainer — These two-part training devices are designed to procedural training on one major aircraft system at a time. Each system trainer is composed of two parts — the components of the system which man interacts with (e.g., controls, displays, indicators, etc.), and a large schematic display of the system. Manipulation or activation of the system controls is reflected by changes in the status of indicators and displays and also by changes in the schematic display.

The recommendations were accepted and implemented; the results of that implementation process has placed American in the forefront of the aviation industry with respect to training. At the present time the most outstanding example of the results of American's commitment to advanced training concepts is the DC-10 flight crew training program. Developed in conjunction with the McDonnell-Douglas Corporation this program is based on carefully stated behavioral objectives which have been translated into instructional materials intended for individually paced instruction. These materials take several forms: sound/slide packages and videotapes for knowledge acquisition, system trainers for initial skill acquisition and procedural practice, cockpit procedures trainers for skill integration and more procedural practice, a motion based simulator for skill integration and practice, and the aircraft for validation of training and certification.

The DC-10 program has been extremely successful; to date, 200 crews (600 crewman) have been trained in the program with a normal completion time of 10 days as compared to the 15 to 19 days for the industry's standard classroom and cockpit procedures trainer program for aircraft of equivalent complexity.

INSTRUCTIONAL DEVELOPMENT

All courseware developed in the last 3 years and all that is presently under development are based on Specific Behavioral Objectives (SBOs) developed in accordance with the guidelines developed by the Air Transport Association, Training Committee and its members. The process for developing SBO's and converting them into instructional material is extremely close in concept and execution to the Air Force's ISD approach.

Once the SBO's were developed, American prepared sound/slide and videotape presentations that were specifically designed for individual use. These presentations are backed up by structured exercises on the systems trainers and by the flight crew operating manual. The SBO's are also the foundation of all exercises in the cockpit procedures trainers and the flight simulator.

COURSEWARE PRODUCTION

Courseware production is the responsibility of the Program Development Division of the Flight Training Department. The division supports both the ground school and flying training groups. This support varies from preparing flight training forms to audio visual aids; from specifying training characteristics of devices, to preparation of complete training programs. In every case, the flight or ground instructor group has the technical expertise and Program Development has the expertise in preparing the material in a sound training format.

Activities of these three groups are coordinated under the direction of the Flying Training Director. He establishes training policy and assures that each group is making a full contribution to carry out the policy. Such direction is of particular importance when a new training technique is to be implemented.

The Simulator Engineering Department is responsible for all aspects of training equipment support. This includes the design, development, specification, acquisition, acceptance testing, in-house production, maintenance, modification, and overhaul of training equipment required by the Flight Academy and Flight Service College. Equipment complexity ranges from the basic classroom teaching aid to the flight simulators.

MAINTENANCE PHILOSOPHY

Updating and revision of courseware is a continuing task for the Program Development Division. Since the aircraft and operating procedures within the company are constantly being altered, the associated training programs must be changed.

Revisions to training manuals must be issued to all crewman who were issued the original manual. The urgency of these revisions depends on the importance of the change; some must be issued immediately, while some can be held pending further changes. Slide/tape and video programs must be updated to reflect the latest changes. These require more production time than manual revisions and must be closely coordinated with the Program Development Divisions's Audio Visual Group.

All equipment maintenance is handled by the Simulator Engineering Department.

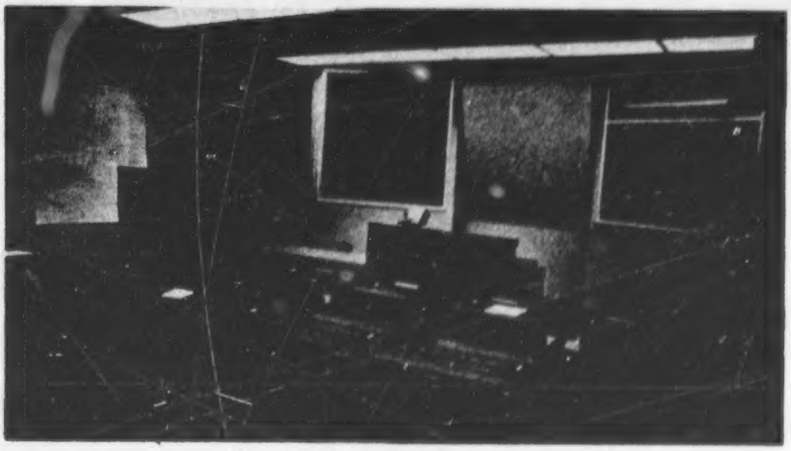
MC DONNELL DOUGLAS CORPORATION
(DC-10 Flight Crew Training Center)

The DC-10 Flight Crew Training Center program was established to provide the most efficient and effective training possible for those personnel responsible for the operation of the DC-10 aircraft. Training programs are designed, presented and delivered to those organizations acquiring DC-10 aircraft. These programs are custom designed by Douglas for each airline customer based on the specific aircraft configuration, procedures and flight profiles of each customer. Four different courses are offered to each organization at the time of aircraft purchase, these are: Management Course, Ground School Instructors course, Flight Crew Course and a Cabin Attendants course.

Until quite recently the Flight Training Center's programs, while designed for line operating crews, have been presented to airline personnel responsible for introduction of the aircraft into service and for training of other airline personnel. The emphasis of the centers present programs has shifted slightly as it begins to provide training to smaller carriers and to non U.S. carriers. In these programs Douglas' emphasis has shifted to providing all of the training for a carrier's line operating crews.

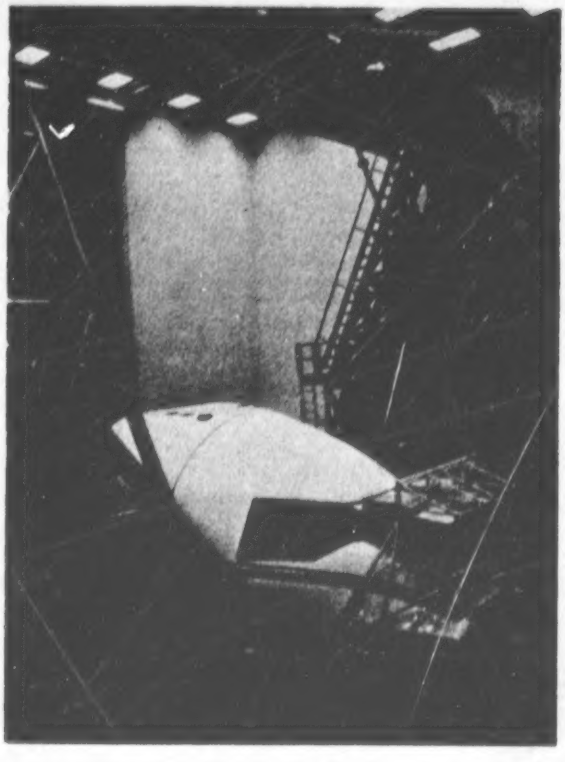
The Flight Training Center's instructional approach is the factor that warrants its inclusion in this study. The heart of Douglas' approach is the determination of the specific behavioral objectives (SBO's) underlying every function performed by flight crew members in the operation of the DC-10. These SBO's are the foundation of the entire DC-10 training program. As shown in the figure below, every element of the DC-10 training program is keyed to the SBO's - each airlines specific training requirements are either generated by the SBO's totally or are the source from which the SBO's themselves are generated. Training program development represents the translation of the SBO's into the training materials and presentations required to support the selected instructional strategies, methods and media.

Instructional development at the Flight Training Center is carried out by the Instructional Systems branch. This branch, headed by an instructional systems designer, is composed of 16 specialists - one for every major system in the aircraft - who share two major responsibilities; they are the individuals responsible for the identification of the SBO's for their respective subsystems, and they are the principal instructor for that system. In their role as the instructional developer, these individuals were responsible for the determination of SBO's for every system and function on the aircraft during the design and development phases of the DC-10 program. This required the development of close ties with the respective engineering departments which are presently maintained to insure that equipment configuration and procedural changes are reflected in the SBO's and in the training materials.



One of the four classrooms used during DC-10 Flight Crew training.

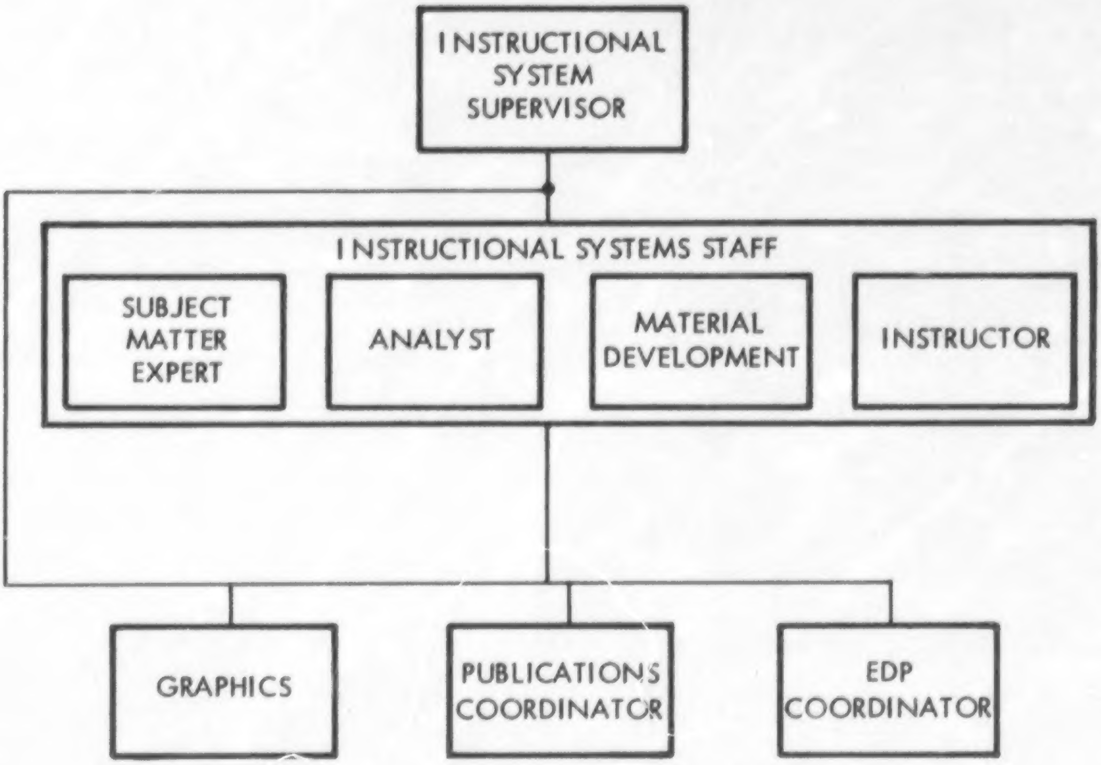
Students working at the Flight Engineers Panel of the Cockpit Procedures Trainer (CPT). The Instructors console is shown at left.



The DC-10 Flight Simulator.

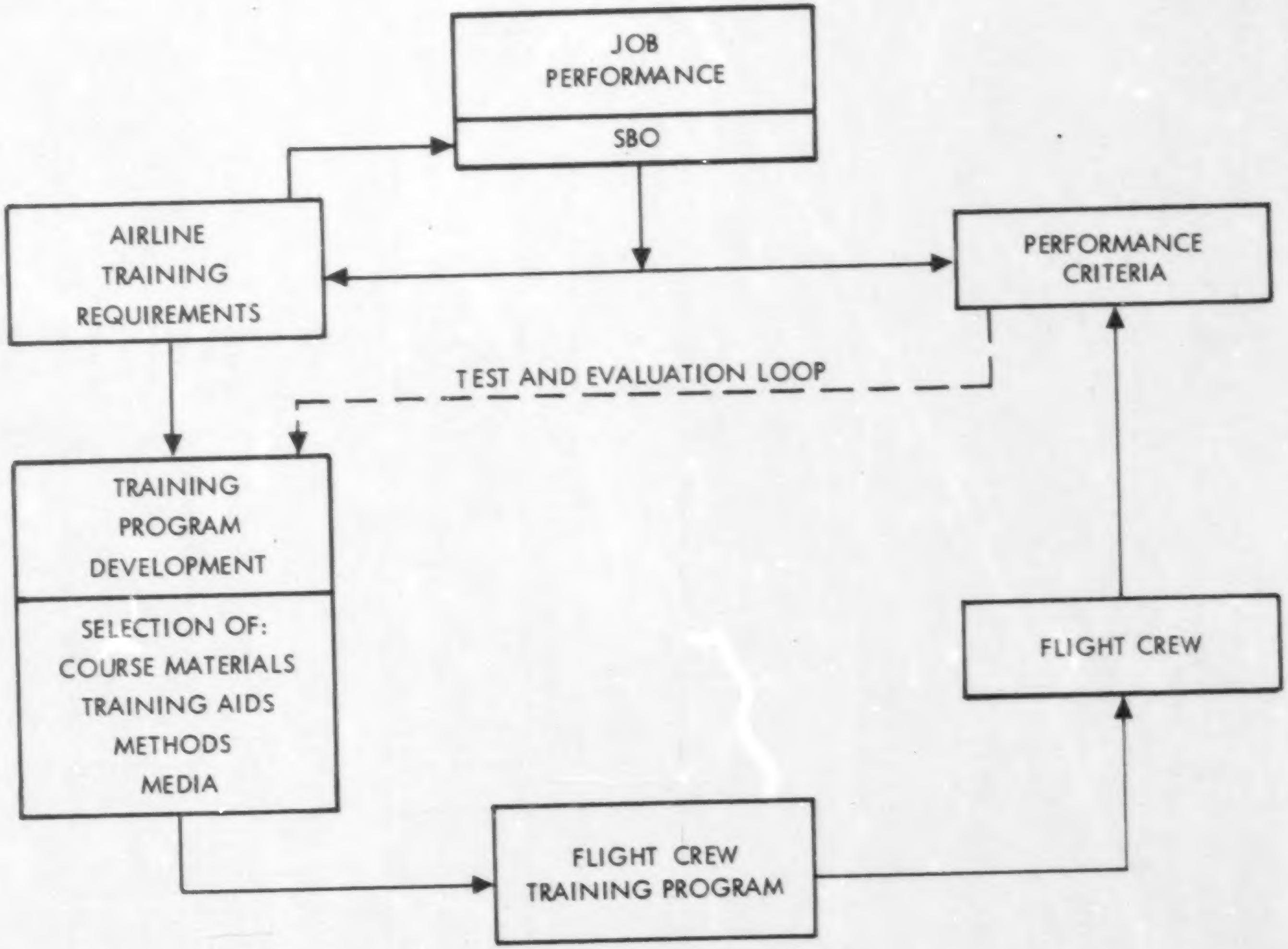
INSTRUCTIONAL DEVELOPMENT

Instructional development for the Flight Training center is conducted by the Instructional Systems branch. This branch is responsible for the development of the SBO's, translation of the SBO's into training materials including scripts, preparation of visuals and the publication of all instructional and procedural materials. The staff of this branch is composed of the following personnel organized in the manner shown below:


INSTRUCTIONAL SYSTEM SUPERVISOR
INSTRUCTIONAL SYSTEMS STAFF
SUBJECT MATTER EXPERT
ANALYST
MATERIAL DEVELOPMENT
INSTRUCTOR
GRAPHICS
PUBLICATIONS COORDINATOR
EDP COORDINATOR

DC-10 INSTRUCTIONAL SYSTEMS ORGANIZATION

FIGURE 2


JOB PERFORMANCE
SBO
AIRLINE TRAINING REQUIREMENTS
PERFORMANCE CRITERIA
TEST AND EVALUATION LOOP
TRAINING PROGRAM DEVELOPMENT
SELECTION OF:
COURSE MATERIALS
TRAINING AIDS
METHODS
MEDIA
FLIGHT CREW
FLIGHT CREW TRAINING PROGRAM

DC-10 INSTRUCTIONAL DEVELOPMENT
FIGURE 3

Courtesy of McDonnell Douglas

Training is conducted in two primary forms: i.e., programmed lectures in the classroom and Cockpit Procedures Training (CPT) exercises. The lectures are sound/slide presentations with integral response frames requiring student responses. The instructor initiates, monitors and evaluates the progress of each lecture, however he is required to address only the SBO's within a given block of instruction. The instructors task is one of interpretation or explanation, not of exposition.

CPT training is integrated with the classroom sessions to maximize the transfer between the presentation of information and its application in the hands-on environment. Within the CPT, sound/slide presentations are used to introduce certain blocks of instruction and audio-only presentations are used to pace practice sessions.

Subjective assessment of the Flight Training Centers performance by its users (airline staff and management personnel) and McDonnell Douglas management as well as the available criterion measures (Flight School performance and FAA examination results) indicate that the Flight Training Center and the DC-10 training program are satisfying the goals for which they were established.

The personnel functioning as the instructional systems staff wear several hats in that they function as subject matter experts, instructional writers and instructors. This arrangement has been very successful and is felt to be one of the major factors contributing to the effectiveness of the whole approach at McDonnell Douglas.

The polished quality of the instructional materials used at the Flight Training Center (and provided to each DC-10 purchaser) is due to the efforts of the Photo/Graphics and Publication Coordinators. Their function is the establishment and maintenance of uniform format and style for the graphic and textual materials required to support the training program. These individuals work directly with the instructional staff to insure the accurate translation of the instructors ideas into photos, graphics and textual materials; however, their responsibility is to the Instructional Systems supervisor for maintenance of quality and style control.

COURSEWARE PRODUCTION

Instructional packages used at the Flight Training Center include sound/slide presentations, audio tapes, and video tapes.

The sound/slide presentations are designed by the Instructional Systems staff, and executed by the McDonnell Douglas Corporation's graphic arts and photographic organizations. Audio portions of these presentations are recorded by the Instructional Systems staff and duplicated locally as are the audio tapes used in the CPT training sessions.

Initially the Flight Training Center had intended to employ a broader mix of media than they presently use, however, they now feel that their present level of mediation is sufficient to meet the requirements of their programs and the student propulations they serve. The prenarrated slide presentations they employ offer the benefits of portability, ease of updating and/or revision and reasonable cost.

MAINTENANCE PHILOSOPHY

Hardware maintenance for presentation devices (projectors, audio playback devices, etc.) is handled by McDonnell Douglas Corporation shops and facilities external to the Flight Training Center. Maintenance for the CPT's and the DC-10 Simulator are provided by technicians on the Flight Training Center Staff.

Maintenance of instructional materials is the responsibility of the Instructional Systems staff as discussed above.

EASTMAN KODAK CORPORATION
Rochester, New York
(Marketing Education Center)

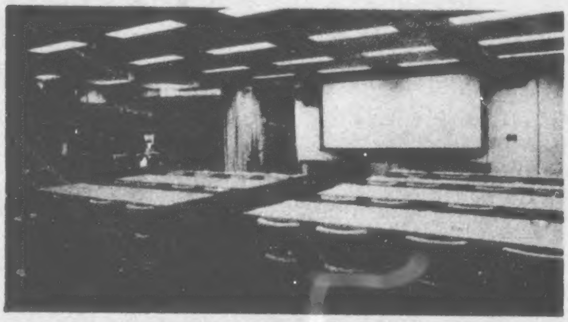
Eastman Kodak's Marketing Education Center (MEC) just outside of Rochester, N. Y. represents the combination of 20 previously autonomous training organizations into an integrated organization, function and facility. The center represents the integration of previously autonomous training groups, into an organization designed to provide a focus for all training development and implementation within 12 separate product areas (Business Equipment, Consumer Markets, etc.). Its function is to develop and to conduct training programs at the MEC, to operate the MEC and satellite centers around the nation.

Several features make the Marketing Education Center an important element in our learning center sample. First among these is the mix of instruction offered - the center services 500 to 600 students per day and offers 150 to 175 different courses during the year, these courses range from 3 days to six months in length and average about five days. The range of subject matter is equally broad covering the spectrum from retail sales to equipment repair to radiology to technical representative training. Approximately 50% of these courses are taught by the lecture-demonstration technique - amply supplemented by audio-visual material - 10% are conducted as seminars and the remaining 40% as laboratory courses. In this last group of courses is the one course that Kodak has converted to individualized instruction - Business Equipment Service Representative - with a reduction in duration from 4 to 2.5 weeks. The success of this course has led them to initiate development of several other courses on an individualized instructional basis.

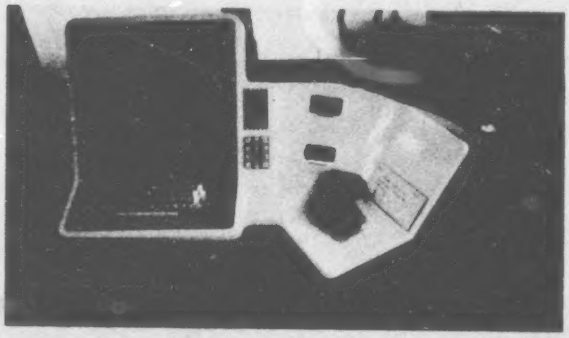
The process and procedures evolved by Kodak for developing instruction are also worthy of comment. Their approach represents ISD or SAT carried to the level where it is common operational procedure - it is the only way they develop, modify or update instruction. While the terminology and the formats may differ, the logic and intent of their approach is what the ISD concept is all about, and it is being successfully applied and implemented across a large cross section of technical training programs.

The third aspect of this operation that merits comment are the facilities available for training. Riverwood - the Marketing Education Center's facility has 390,000 square feet devoted to instructional development and training. The facility was developed from a set of functional and educational specifications prepared by the centers staff - the result is a functional yet esthetically pleasing facility, tailored and adaptable for training of the widest spectrum of skills observed during this survey.

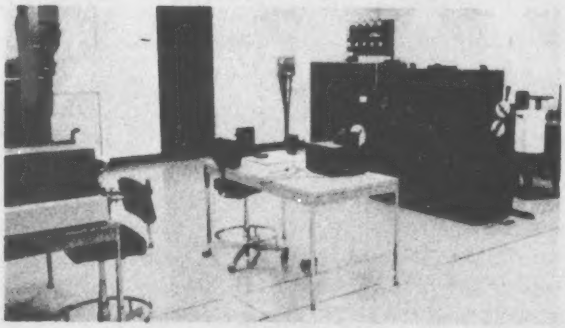
The Marketing Education Center was specifically designed to accommodate Kodak's large training organization. These are typical of the spaces assigned to Instructional Development functions.

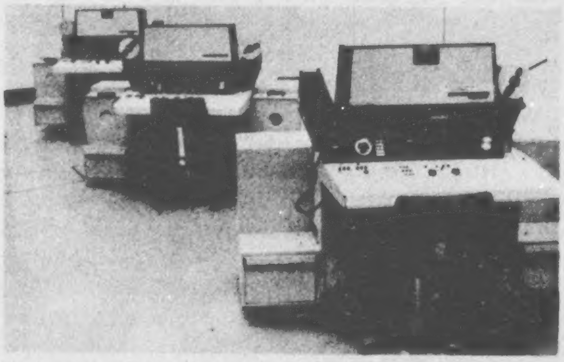


The largest majority of the Center's classes are still conducted as lecture/demonstrations. This classroom is used to conduct retail sales training; the simulated store setup is both for demonstration and practice.

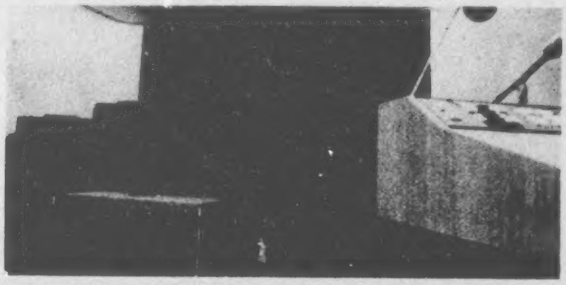


Kodak's Interactive Training Terminal: display screen above the Keyboard presents computer generated material, data identified via the Keyboard and the images from the microfiche projection system. Audiofiche (upper slot) and microfiche (lower slot) are fed into the two slots in the center of the console. The access door for the digital cassette can be seen on the right side of the device.

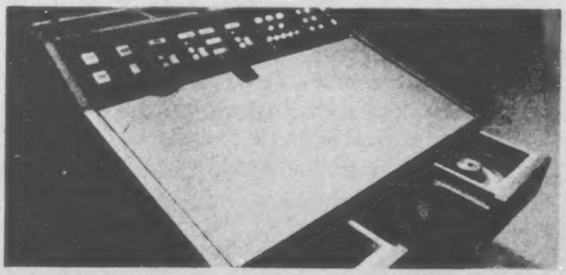




The Marketing Education Center contains a large number of well equipped laboratories designed to support training in all aspects of the photographic sciences.



View from the instructors podium of one of the four major classrooms/auditoriums at the Center. The projection booth in the rear of the room can be staffed by an operator or all functions can be slaved to the instructors console.



Projector controls, lighting controls, sound system operation and controls for the classrooms revolving stage are available to the instructor at this podium.

Eastman Kodak has made a large and thoughtful commitment to their training center, it is in its entirety a learning center encompassing every element contained in the model discussed earlier. In addition to being noteworthy in terms of the comprehensive and thorough manner in which the total learning center concept has been implemented, the Marketing Education Center has certain other distinguishing features. The first of these is the documented effectiveness of individualized instruction. Kodak's Business Equipment Service Representative training course previously took 4 weeks when taught as a conventional lecture-demonstration course; in its present form - an individualized, self-paced program of instruction - it is producing students with the same skills in 2.5 weeks.

An integral element of this course is a program of Computer Assisted Instruction. Kodak's CAI system uses a PDP-11 computer and student consoles designed, and built by Kodak's Learning Systems Laboratory. These consoles will, on demand or instruction from the computer, display any of 128 color, continuous - tone photographic images in not more than 0.3 second. Replace the 70 mm x 125 mm (approximately 3 x 5 inches) microfiche in the console will give access to another 128 images (at a 30X reduction). The rear projection screen of the console incorporates a "plasma panel", on which the computer or the student can generate numbers, letters, words, graphs and other line drawings.

The student console is also able to present over 20 minutes of prerecorded sound, divisible into as many as 140 audio messages each accessible in less than 0.5 second. A digital tape cassette unit in the student console functions as a tape unit would on a larger computer, it expands the PDP-11's memory: the cassette carries the digital portion of a lesson and is keyed to a given set of film images and sound messages. The cassette also acquires and stores the individual students record on that lesson.

Another aspect of the Marketing Education Center that merits particular attention is the extensive and well equipped practical training areas available; these include facilities for hands-on training in every aspect of photographic, radiological and graphic arts operations.

HUGHES AIRCRAFT COMPANY
El Segundo Manufacturing Division
(Education and Training Center)

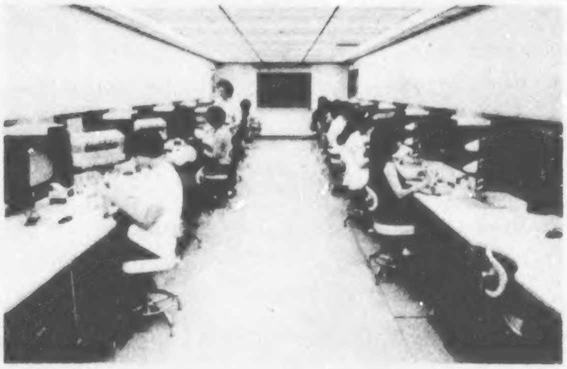
The El Segundo Manufacturing Division of the Hughes Aircraft Company employees 6,000 personnel. More importantly it must train large numbers of these personnel to enable them to perform at an acceptable level in the high technology environment that characterizes the development and production aspects of the organization.

The Education and Training Center is a section of the Vocational and Technical Training Department. The center is charged with developing, conducting and maintaining the training programs for the Division. While its charter is broad enough to include career development, supervisory, clerical and production line training, the largest emphasis is on the latter. The manufacturing and assembly of the sophisticated systems produced by this facility mandate a large number of manual tasks. The primary criterion applied to all manual and automated tasks in these operations is that of accuracy; to insure maintenance of the required standards of performance demands through initial training, high levels of quality control and a high incidence of retraining.

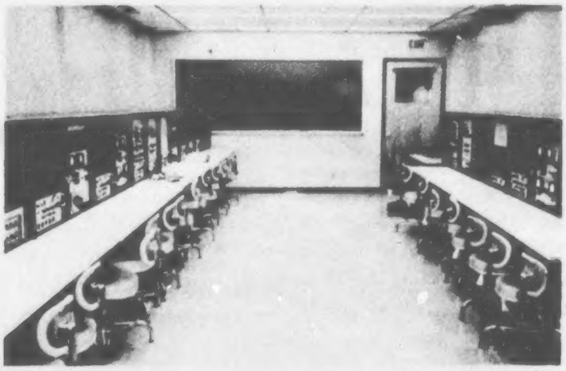
To meet these requirements, the Education and Training Center is charged with the development and conduct of both vocational and technical programs. The largest amount of time and effort has been expended on the development training programs for electronic assembly personnel and it is this aspect of the Training Centers operation which is of direct interest to this study. As was mentioned above, accuracy is the primary objective in the manufacturing activities carried out at this facility.

In order to insure the accuracy required and to reduce the probability of assembly errors or out-of-tolerance assembly, Hughes has devised a unique visually-assisted assembly procedure which lends itself to training as well. All electronic assembly positions at this facility are equipped with a rear projection view box designed for the Kodak Carousel slide projector. These view boxes are used to present each step in a given assembly operation to the technician. As each assembly task is completed, the technician advances it to the next slide, which is the next step in the assembly process. During entry-level training and in the periodic retraining and certification courses provided by the center, technicians are taught using the same procedures and the same presentations and instructions as supplemented by an instructor on an as-required basis.

Adoption of this approach has allowed the introduction of individually paced instruction to the centers operation while maximizing the transfer between the instructional and operational environment.

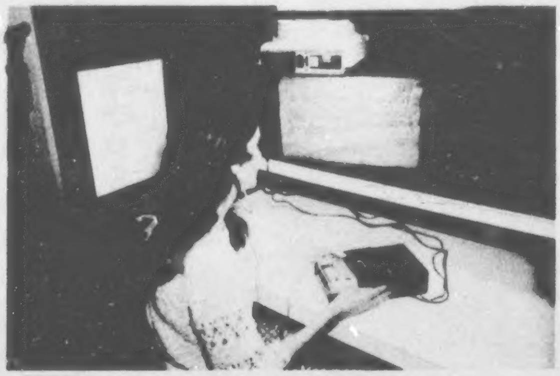


Electronic Assembly Training area in the Education and Training Center. Except for the small room size, the facilities, equipment and configuration for each student station is identical to that found in the production areas. In front of each student is the slide projection system used for training and to provide productions instructions on the production floor.



Classroom set for instruction and certification of electronic inspectors and technicians.

Two of the classroom configurations used for supervisory and other types of non-production line training. These two rooms are located side-by-side and are served from a centralized audio-visual control room.



Study carrel configuration used in the Education and Training Center.

INSTRUCTIONAL DEVELOPMENT

The staff of the Education and Training center is directly responsible for the development of the instructional materials. This responsibility is tempered somewhat by the interaction between the planning and development personnel of the manufacturing facility. The instructional packages for electronic assembly training are designed initially for use on the assembly lines; responsibility for the design of these instructions/visual procedures is the responsibility of the manufacturing planning organization. Manufacturing planning includes on its staff, individuals who are responsible for planning the visuals to illustrate the assembly procedures. The instructions from these visualizers are translated by the photographic staff into the slides on the line and in training.

For training in areas other than manufacturing, instructional development is the responsibility of the education and training center staff; it is carried out in the conventional manner with the instructor having the responsibility for instructional development process.

COURSEWARE PRODUCTION

Manufacturing and assembly training courseware consist almost entirely of the slide presentations used on the line; these visuals are designed by the manufacturing planning group and are photographed by the divisions photo staff. All images used are photos, no graphics are used. Original imagery is photographed on Ektachrome and all processing and duplication is handled by commercial laboratories.

For other than manufacturing training, responsibility for courseware development lies with the Media Presentation unit. This unit helps instructors to design their presentations for mediation and provides the photographic and graphic arts support necessary to produce the presentation. The majority of these presentations are slide-supported lectures; however, there is some use of video. Motion pictures developed for other purposes are used to supplement instruction.

MAINTENANCE PHILOSOPHY

Hardware maintenance is carried out on an as-required basis by the Media Presentation staff. Minor maintenance activities are conducted on-site and in-place, if possible. For massive failures or unidentifiable failures outside services are used. It is interesting to note that in the assembly areas, the Kodak slide projectors are subjected to 8-hour a day, 5-days a week operation, their operating experience has been that lamp failure and replacement is their highest maintenance cost and that the life expectancy of the projectors themselves is between 400 and 600 hours before bearing failure (due to the bearing surfaces drying out) or electrical contact failure retires a projector.

Courseware for manufacturing and assembly training is automatically updated every time the process or procedures change. When new slide packages are prepared for the line, the required number are automatically provided to the Training Center. Courseware for supervisory and management training programs is updated infrequently.

IBM CORPORATION
Office Products Division
Lexington, Kentucky
(Customer Engineering Education Department)

The Office Products Division of the IBM Corporation is responsible for the production, sales and service of typewriters, dictation equipment and other similar products including MTST and composers. The IBM Customer Engineer (CE) is the individual responsible for the servicing and maintenance of these products. The CE "baseline" training program is designed to take input level employees and raise them to a stated level of competence in the diagnosis and repair of what are known as "baseline" products; these include several types of typewriters and all dictation equipment. This is the OPD divisions course with the highest population (1,000 students per year) and is presently designed as an individualized self-paced program. The objectives/criteria for this course are based on data acquired from the field-high failure, high repair time, high repeated complaints. Training is designed to provide mastery of the skills that the CE will require in most service calls.

The conversion of the baseline program from conventional classroom training resulted in several things:

a) Reduction of training time from 17 weeks to 11 weeks.

b) Conversion from a centralized training program to a decentralized system.

c) Reduction in emphasis on theory to an almost total emphasis on hands-on training.

d) Reduction of "students awaiting training" to O.

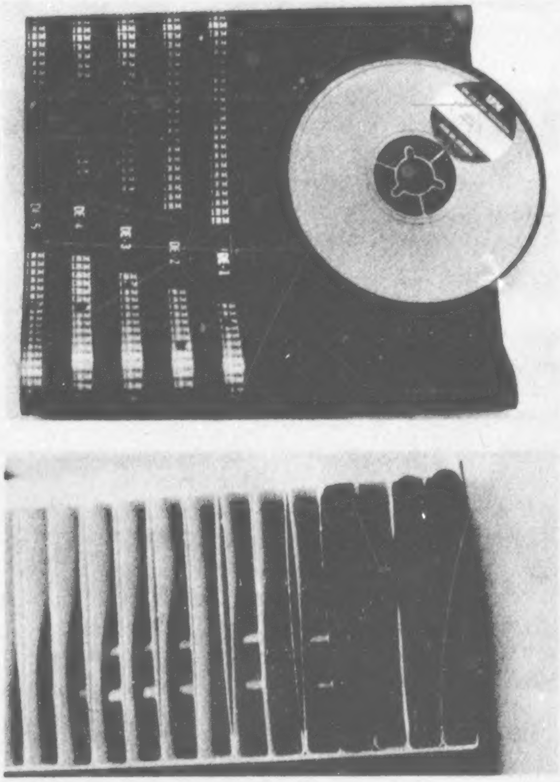
e) Baseline graduate performance equivalent to that of men with two years experience.

f) Reduced and redistributed costs - costs reduced approximately 15%, but more importantly a redistribution of costs from student support to instruction.

Instruction in the baseline course, and some of the more advanced CE programs, has been converted to self-paced instruction which is presented by a combination of text, still visuals, audio presentation, and actual equipment. Interestingly - the texts bear close resemblance to the Air Force JPA style, while the visuals are Super - 8 mm filmstrips and the audio presentations are on IBM Dictabelts. This approach has enabled IBM to develop a very compact instructional packaging system - which works.

Study carrel configuration typical of that found in OPD offices around the country.

Each carrel is equipped with a Super-8 mm projector, screen module, and audio playback unit (shelf under projector). Training emphasizes audio-visual instructions and hands-on equipment training.



IBM's audio visual instructional materials are well packaged. The five belts and single roll of film represent a weeks worth of instruction. The box contains the entire baseline training program.

One of the most interesting aspects of IBM's approach is their centralized development and quality control system coupled with decentralized training. Students undergo training utilizing the self-paced training materials at any of 96 Office Products Division field offices. This training averages approximately 11 weeks and is interspersed with five, one day on-the-job "breaks" to relieve the regimen of the long stretches in the carrel. At the completion of the base-line training program, trainees are taken to the Office Products Division headquarters in Lexington for the quality control phase of the program.

The quality control aspect of IBM's program consists of an extensive series of equipment diagnosis and repair exercises for which both time and error data have been compiled from the field and from previous trainees - students are presented with a continuing series of faulty pieces of equipment and are expected to complete diagnosis and repair within the established time and error standards.

COURSEWARE DEVELOPMENT

All instructional materials are developed at IBM's Lexington Facility. The instructional development cycle commences with the introduction of a new piece of equipment to the Office Products Division line, or with managements decision to expand the self instructional materials to cover an existing product still taught via classroom instruction. The next sequence involves the assignment of an instructor/subject matter specialist who performs two major functions: he identifies the performance objectives to be met by the student and he develops the procedures for accomplishing these objectives. As he completes his tasks, the educational validity of his objectives are reviewed, and the entire objective/procedural package is validated by a second subject matter expert operating independently who actually executes the procedures on the equipment. Field training and/or performance data are used to cross check and refine the results of this process. The last step in the process is train personnel with the new material, and in the case of existing equipment to match their performance against personnel trained with previously available techniques.

COURSEWARE PRODUCTION

All production tasks, except duplication of multiple copies, is carried out at the Lexington facility. The production department is staffed by technical writers, graphic artists, illustrators, photographers and is headed by a presentation design specialist who manages the total activity. Working with the material produced by the education group, the production department converts the objectives and procedures to the standardized format and assigns an illustrator to work with the subject matter expert in developing/designing visuals which convey the desired information. As a result of this process, a storyboard is developed which is verified by the subject matter expert and the education group.

Once the storyboard has been approved, final art is developed and copied. Live shots of actual equipment manipulation are shot in one of the two studios available expressly for this purpose. All copy work and studio shots are originated in 35 mm color; when all shots have been compiled and edited a 16 mm color master is made (either in Lexington or at a commercial lab). The master is then used to produce Super - 8 mm duplicates filmstrips for use in the field.

MAINTENANCE PHILOSOPHY

Courseware maintenance is a continuing function at Lexington with better than half of the production operation being assigned to this task all of the time. Equipment maintenance requirements are minimal in that all training equipment and the audio portion of the study carrel are being maintained by the students as they undergo training. The one item that does incur some maintenance problems is the Super - 8 projector used (Kodak MFS-8's); since these are used as filmstrip projectors and normally operate eight hours a day, five days a week, the incidence of failure is higher than would be experienced in other applications of the same projector.

BRIGHAM YOUNG UNIVERSITY
(Dvision of Instructional Services)
Provo, Utah)

The Division of Instructional Services at Brigham Young University (BYU) represents the largest organization included in this survey. The division's learning center is the entire university per-se, and while all of the elements of the learning center model are represented by the division in its service to BYU, the manner in which those elements are operating makes this member of our survey both representative and unique. The developmental and production arms of the Division of Instructional Services are organized and function in the same manner observed in other successful centers; it is in the presentation of instruction to students that the division becomes somewhat unique. Because of the large student population (25,000 student on-campus) it serves and the relative youth of the Instructional Development aspects of the program, a large amount of the efforts of Division of Instructional Services are devoted to supporting or distributing large group instruction of the conventional type. However, as time and budget permit both the content and the strategies of these courses are being altered to accommodate more innovative approaches.

The Division of Instructional Services was designed and organized with the intention that it provide complete instructional development and media support to the academic curriculum at BYU. To do this the division is organized as shown in Figure 4-5. The Instructional Development Program element in this structure is a coordination function which directs the application of the divisions resources to a specific problem.

The Department of Instructional Research & Development has three broad functions: [5]

1) Instructional Development consists of the design and production of empirically validated instructional systems, subsystems and materials for college instruction as well as the evaluation and revision of existing instructional systems, subsystems and materials for college instruction;

2) Instructional Research conducts laboratory research on basic educational materials and on the effects of using educational media and research on systems for the production, development and distribution of instructional packages;

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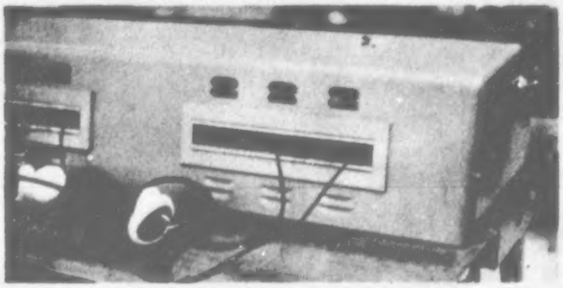
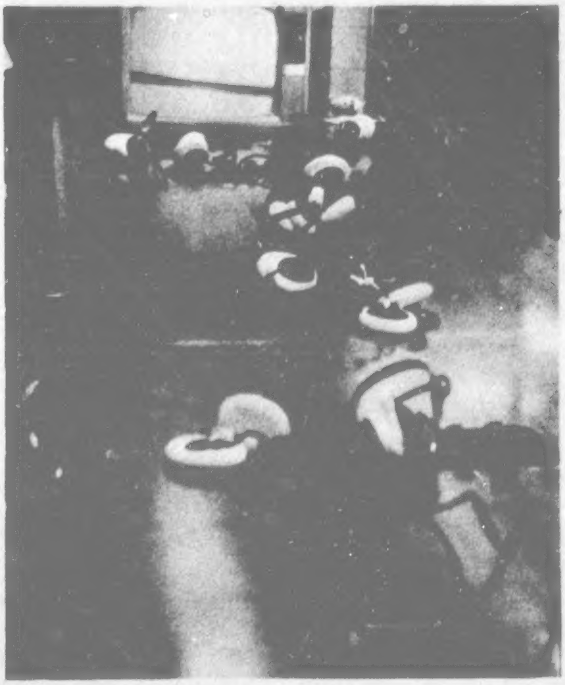
[5] 'Division of Instructional Services" Mediated Learning Systems Newsletter, Vol. 4, No. 1, September 1971, Brigham Young University.

Entrance to the university's Learning Resource Center located in the main library.



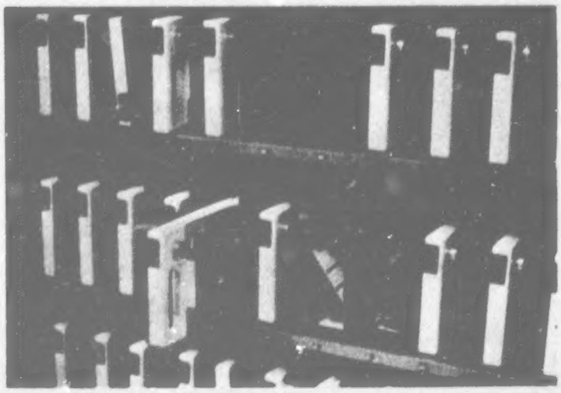
Another of the carrel configurations used in the Learning Resources Center. Each position in this bank of carrels is served by the manually controlled audio distribution system. The student selects his program by patching into the appropriate channel.



The University's cable network, or videotape playback units in the Learning Resources Center can be patched into this group viewing station. There are two such stations in the learning resource center

Three of the different types of carrels in the Learning Resources Center. The carrels in the foreground are intended primarily for audio presentations from one of the centers, two audio distribution systems.

The manually controlled audio distribution system is served from this central core of reel to reel tape decks, and record turntables. Amplifiers for each channel in the system are located on the shelves above the playback units.



Student may check out these cassette units for use with prenarrated instructional tapes at locations other then the Learning Resources Center.

3) Faculty Training provides faculty workshops on instructional design, conducts faculty seminars in effective media use and production, and sponsors symposia in innovative instructional practices."

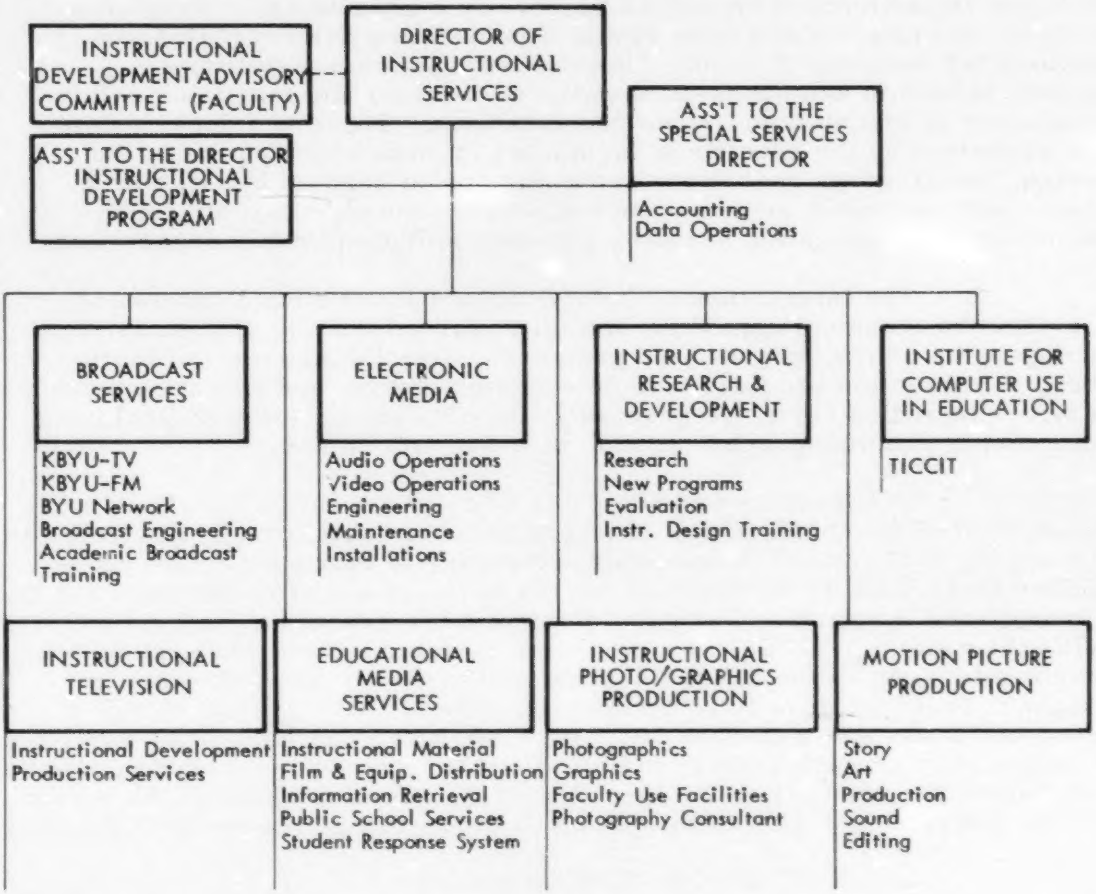
The Educational Media Services Department serves as the distributor for all media presentations and equipment used on the university campus. This department also operates an audio-video information retrieval system servicing carrels located in the university library. The Broadcast Services Department operates the university's FM and cable television systems and also operates the Public Broadcasting System (PBS) and TV stations for the state of Utah. This departments responsibilities include academic and hands-on instruction in radio and television and the production of instructional video presentations. These two departments are supported by the Electronic Media Department which provides the design, installation, operation, and maintenance support for all audio, video, and electronic systems and equipment used on campus. Audio recording and duplication services are also provided by this department.

The Instructional Photo/Graphics Production Department provides the technical capability and talent for production of 35-mm slides, photographic prints, charts, and graphics. The Department of Motion Picture Production provides complete motion picture and filmstrip production services including script preparation, story boarding, artwork (including animation), cinematography, sound recording and editing.

The Institute for Computer Uses in Education (ICUE) is a new department of the Instructional Services Division; it is broadly chartered to investigate applications of computer technology to education. At a more applied level ICUE is responsible for the development of courseware for the Time-shared Interactive Computer Controlled Instructional Television (TICCIT) system. TICCIT is a computer assisted instruction system being developed jointly by the Mitre Corporation (hardware and software) and Brigham Young University (Courseware). The TICCIT system is being developed to demonstrate that CAI can be produced, packaged and delivered economically; as such a great deal of effort has gone into developing efficient and, hopefully (the system itself is untested), effective methods for developing the instructional materials which will be presented via the TICCIT system.

INSTRUCTIONAL DEVELOPMENT

The instructional development process at BYU, presently takes place in two separate programs; the first of these is the Instructional Development program of the Division of Instructional Services. The Instructional Development program is designed and operated to meet two goals:


INSTRUCTIONAL DEVELOPMENT ADVISORY COMMITTEE (FACULTY)
DIRECTOR OF INSTRUCTIONAL SERVICES
ASS'T TO THE SPECIAL SERVICES DIRECTOR
Accounting
Data Operations
ASS'T TO THE DIRECTOR INSTRUCTIONAL DEVELOPMENT PROGRAM
BROADCAST SERVICES
KBYU-TV
KBYU-FM
BYU Network
Broadcast Engineering
Academic Broadcast Training
ELECTRONIC MEDIA
Audio Operations
Video Operations
Engineering
Maintenance
Installations
INSTRUCTIONAL RESEARCH & DEVELOPMENT
Research
New Programs
Evaluation
Instr. Design Training
INSTITUTE FOR COMPUTER USE IN EDUCATION
TICCIT
INSTRUCTIONAL TELEVISION
Instructional Development
Production Services
EDUCATIONAL MEDIA SERVICES
Instructional Material
Film & Equip. Distribution
Information Retrieval
Public School Services
Student Response System
INSTRUCTIONAL PHOTO/GRAPHICS PRODUCTION
Photographics
Graphics
Faculty Use Facilities
Photography Consultant
MOTION PICTURE PRODUCTION
Story
Art
Production
Sound
Editing

DIVISION OF INSTRUCTIONAL SERVICES

FIGURE 4

1) To increase the quality of instruction at BYU through the design and production of validated instructional packages;

2) And to increase the cost effectiveness of the University's instructional program.

Faculty members are encouraged to submit proposals for instructional development projects; twice a year these proposals are reviewed and those that are accepted are funded to a level permitting the design, production or purchase of validated instructional materials. In a large percentage of these projects the funding extends to released time for a faculty member directly involved in the development project. The Instructional Development Program consists of five phases:

1) Project Initiation - Proposals, review, approvals, budgeting, development team organization.

2) Analysis Phase - Student characteristics described; type of learning identified; terminal and enabling objectives specified; terminal intermediate, and pro-entry evaluation procedures developed.

3) Strategy Phase - Modes and media analyzed and selected, instructional strategy developed, budget-time estimates updated.

4) Packaging Phase - Available instructional materials evaluated, purchased, and adapted as necessary; additional instructional materials produced; instructional package assembled; preliminary tryouts conducted and necessary revisions made.

5) Validation Phase - Actual-use validation conducted and revisions made, instructional package put into regular use, final report - prepared.

This program has been successfully applied to several of the larger flowrate courses at BYU, and is presently being applied to others.

The other approach to instructional development being used at BYU is the production model developed for the TICCIT program. This model has been designed to integrate the knowledge of content provided by subject matter experts with the requirements of formal instructional design and a large scale production operation while controlling the internal biases of the individuals assigned to the development and production teams. The model consists of five phases arranged in the following order:

- Authoring [development of the content of an instructional package].
- Designing [conversion of the content into structure compatible with the packaging requirements of the system].
- Packaging [converting the output of the previous steps into hard copy in the correct format, and order].
- Final Revision [based on empirical validation with a sample population, technical changes are made to the package].
- Final Copy [formal production of the material].

The model, while still awaiting large scale validation in the TICCIT field tests, is an extremely solid approach to the instructional design process and is somewhat unique in the roles it assigns to participate.

Subject matter experts are asked to go from the general to the specific by identifying the goals, needs, and justification for the course, then the peculiar needs of the target population (a mastery model which identifies what, in general, we should expect the student to be able to do as a result of the course). The author then blocks out the course by listing the tentative topics to be covered. As these materials are agreed to by peers and the instructional technologists, the subject matter expert provides content in a simple, agreed-to-format. From these materials, the instructional design technician derives objectives which are useful to the program and the student population. This procedure takes many of the constraints off subject matter experts and allows for their participation at what appears to be a less structured level than heretofore.

COURSEWARE PRODUCTION

In identifying the departments of the Instructional Services Division at BYU, we delineated the responsibilities of those departments (Broadcast Services, Electronic Media, Motion Picture Production and Instructional Photo/ Graphics) as they relate the divisions functions. These departments operate their services essentially in the same manner that they would be operated in any large industry or government installation.

MAINTENANCE PHILOSOPHY AND POLICIES

Hardware maintenance for all equipment except the radio and T.V. broadcast equipment, is handled by the Electronic Media Service department. This department maintains a staff of six technicians whose responsibilities include equipment evaluation, maintenance, repair and record keeping on all media equipment.

Courseware maintenance for BYU courses are the responsibility of the instructor(s) and they are supported on an as required basis. Courseware maintenance on TICCIT is handled by the same system described above. Since no hardware for TICCIT is installed at BYU hardware maintenance for that system is not yet a university responsibility.

DALLAS BAPTIST COLLEGE
Dallas, Texas
(Collins Learning Center)

The Collins Learning Center at Dallas Baptist College is an example of a particular class of educational facilities designed specifically for mediated instruction. The center is designed to house and support all facets of instruction at the college. The center houses the college's library collection and operations and all media production, distribution and display functions. Seven hundred and twelve student carrels are supplied with video and audio instructional programs from a dial-access retrieval system. This system functions primarily as a fixed schedule system, but certain audio channels are retained for demand programming. In addition to the central dial-access system, students have access to material on audio cassettes, microfilm, and slides (for individual study).

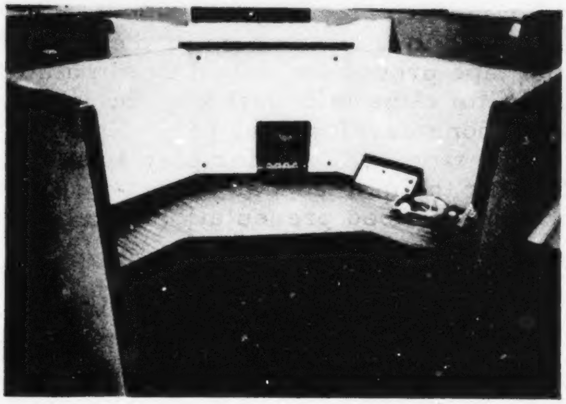
Eighty percent of the freshman and sophomore curriculum (with the exception of laboratory studies) at Dallas Baptist is presented in and through the facilities of the learning center. Upper division programs are in the process of being added to the system but at present are only sporadically supported - either from the dial-access system or from the TAGER system - by the Learning Center. Upper division programs are mostly conventional lectures, labs and/or seminars and are provided outside the Learning Center.

The Learning Center and Dallas Baptist's instructional philosophy are designed to emphasize the expanding range of options available from which a student may learn. Implementation of this philosophy is through the coincident location of resources (including faculty) and the design of courseware to match the facility and equipment capabilities available.

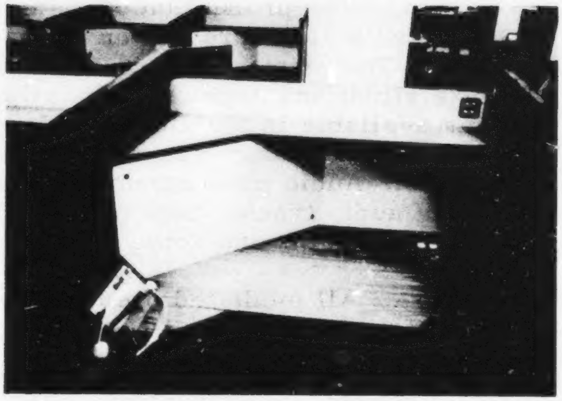
The center is reported to have accomplished two things for Dallas Baptist; it has allowed them to provide college level instruction to their student body at a lower cost than would be possible under a more conventional concept, and it has given the college a focus, a distinctive approach with which to motivate both students and faculty.

COURSEWARE DEVELOPMENT

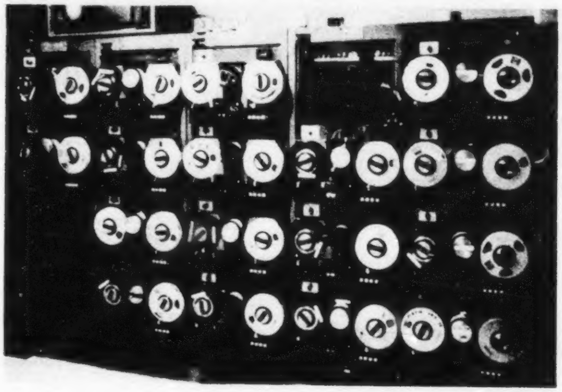
All instructional materials broadcast over the college's dial-access system are developed locally. Commercial materials are adapted for utilization. when appropriate. Mediated presentations are designed by each instructor with the college supplying graphic arts and photographic assistance as required. The sophistication of presentations developed to date vary greatly, ranging from graphically illustrated faculty scripts to media productions utilizing complete documentary presentations involving extensive editing for visual and audio continuity.



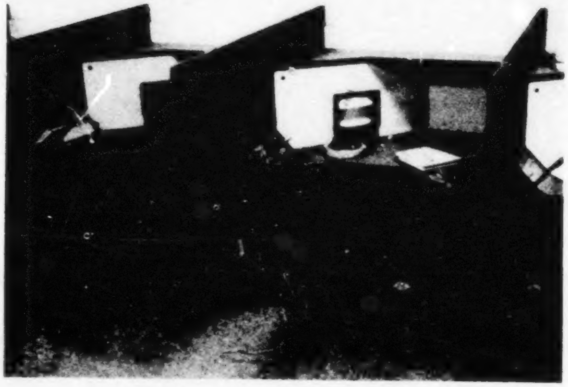
Typical audio-video carrel: 9 inch monochrome video monitor, headset, touch tone controls for the dial-access system.



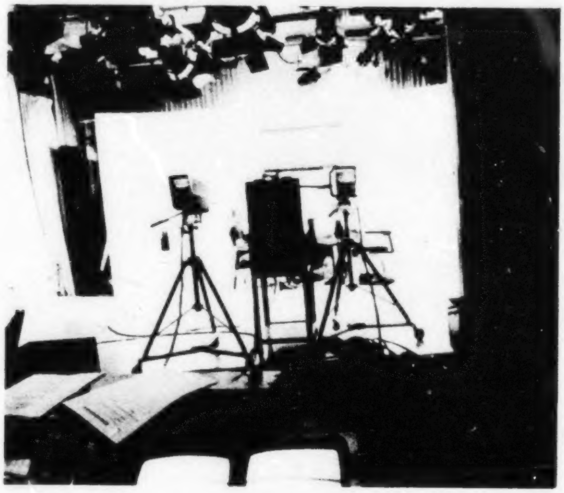
A language laboratory study carrel equipped for audio reception and talk back.



These video playback units are the core of the learning centers dial-access video system.



Video carrel configurations equipped with talk-back system; these carrels are used for courses presented via the Association for Graduate Education and Research (TAGER) network. TAGER is a consortium of Dallas area colleges and universities who present and receive courses via a microwave video relay system. All programs permit two-way communication.



Almost all video presentations used by Dallas Baptist are produced in this studio, located in the learning center.

COURSEWARE PRODUCTION

The production of materials for the learning center is handled by the college's video production operation located in the basement of the Learning Center. The primary emphasis is a video tape production based on simulated lecture situations augmented by slides and film clips introduced by the film chains available in the studio. All presentations developed as part of the scheduled curriculum are recorded on 1-inch tape and filed for play at scheduled intervals. Audio presentations available over the dial-access system represent a mix of audio tracks from previously scheduled video presentations, recordings of guest speakers and some specially developed audio materials.

All mediated presentations are supported by structured outlines provided to the students.

MAINTENANCE PHILOSOPHY

Courseware maintenance is the responsibility of the individual instructor. Equipment and overall system maintenance are the responsibility of the video systems engineers on the college's staff.

ILLINOIS STATE UNIVERSITY
Bloomington, Illinois
(Pyramid System Learning Laboratory)

The Learning Laboratory at Illinois State University presently serves approximately 550 students per week, with most students being from the Department of Education and smaller percentages from Accounting, Psychology and Educational Media.

The Learning Laboratory is distinguished by being the site of one of the largest and most complete installations of the Ampex Corporations, Pyramid System. This system is a complex dial access information retrieval system.

At the time of our visit, neither the full capabilities of the Pyramid System nor the production capabilities for the video portion of the system had been exercised to the extent that any data was available on system operation or effectiveness.

COURSEWARE DEVELOPMENT

In the development of courseware for the Learning Laboratory, the responsible instructor develops the course material content and the laboratory media services then determines the way in which the material can most effectively be presented. In some instances commercially available video tape, audio tapes or sound slide materials are used if they meet the course needs.

COURSEWARE PRODUCTION

Once the instructor develops the course material content he reviews his material with the instructional design group. The instructor and the responsible design group staff member then request the required (video, sound, or art) media services support for production of the required materials.

MAINTENANCE PHILOSOPHY

Maintaining currency of the materials is the responsibility of the appropriate department instructor, with necessary changes and updating coordinated with the laboratory instructional design and media services groups.

The Audio-Visual Center has a full time technician assigned who has been trained by Ampex. If the problem is beyond his capability, contractor assistance is called in. Equipment within the media services group is maintained by staff personnel to the extent possible before contracting for outside assistance.

MT. SAN JACINTO COLLEGE
Gilman Hot Springs, Cal.

Mt. San Jacinto College is a member of the California Community College system. It was established to provide academic and vocational training opportunities to the local community; as such it functions both as a two year junior college awarding AA degrees in various fields and also as a vocational training center. The instructional offerings of the college range from the standard liberal arts courses to an intensive program in secretarial training.

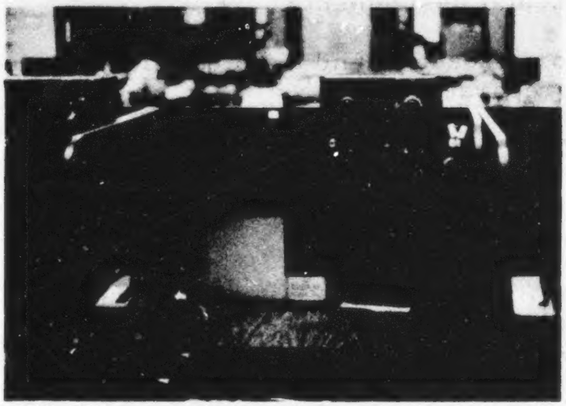
The college functions on an open enrollment basis for residents of the community college district. As a result, the student population is a heterogeneous mix representing a broad cross-section of the community. The college serves 6-700 full time students and an equivalent number of part-time students.

What distinguishes Mt. San Jacinto from the main stream of community colleges and what merits attention in this study are the efforts of the college to provide individualized instruction across the entire scope of their curriculum. Since its creation the college has emphasized and supported the development of individualized instructional material as an integral part of curriculum development and course improvement.

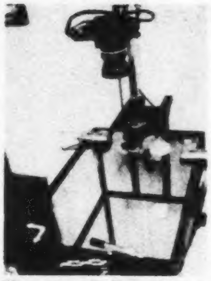
As a result of this emphasis and support, the entire campus at Mt. San Jacinto has become the learning center. Individualized instruction at Mt. San Jacinto emphasizes the use of multimedia instructional materials designed to support specifically stated, measurable objectives. These multimedia materials are available and are used in a diversity of environments throughout the campus. Study environments have been designed and installed in the library and in several of the separated instructional buildings around the campus.

Almost all of the individualized instructional materials used at Mt. San Jacinto are produced by the college in its own facilities. The materials are authored by the members of the college faculty with their peers and the first level supervisor - the Dean of each instructional program (Nursing, Business, Language, Arts, etc.) - acting as the reviewing authority for the content and accuracy of the material. Taped audio presentations form the basis for all instructional units; visuals may be filmstrips, slides, or printed booklets. All production including sound recording, graphics preparation, photography and printing is performed on campus; only the processing and duplication of film materials requires outside support.

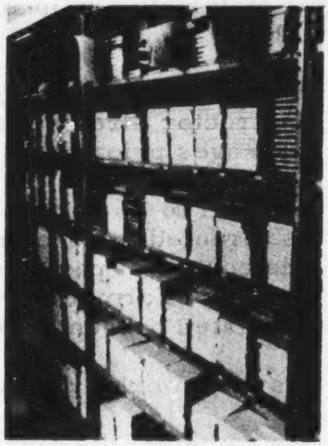
Study carrel arrangements in the college library.



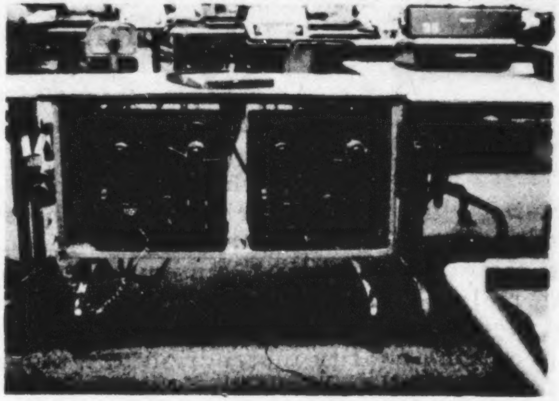
Typical study carrel arrangement: 35 mm filmstrip projector, reel to reel tape playback unit, and projection screen.



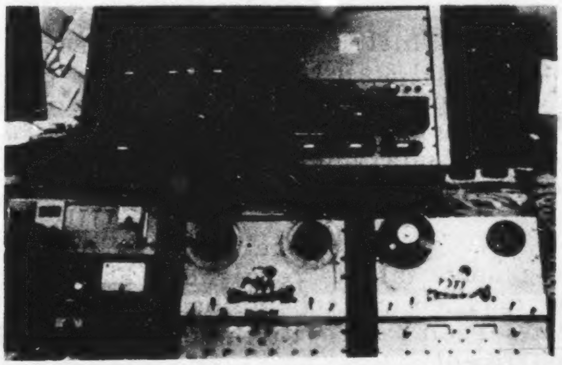
The schools filmstrip production equipment; an Embry-Hamrich optical printer and copystand.



Audio study materials for the secretarial training class, one hundred and fifty hours of instruction is provided via audio presentations.



Audio presentation carrels in the secretarial training area.



Audio tape duplication facilities for reel to reel and cassette tapes.

Mediated materials are incorporated into a variety of instructional strategies, these include:

1) Support to Lecture/Demonstrations. In this mode the instructor directs a student to use certain instructional packages prior to or after a given Lecture/Demonstration.

2) Support to a laboratory exercise. In this mode the student is directed to accomplish certain specific activities - in the course of performing these activities he requires further information which is available in the form of a mediated presentation.

3) As homework or supplemental assignments.

4) As remedial materials for students found to be deficient in some aspect of their preparation.

5) In lieu of certain scheduled class hours.

6) As a replacement of the conventional schedule of class meetings - self-paced instruction.

The last of these represents the goal toward which the college is striving - the remainder represent the strategies that are presently employed to overcome the problems of funding, equipment procurement and the time lag associated with the development of a large volume of individualized instructional materials. The college has found the learning center concept, individualized instruction, and mediated instructional material to be a cost effective approach to providing quality instruction to a diverse population.

INSTRUCTIONAL DEVELOPMENT

Instructional development at Mount San Jacinto is handled by the instructional staff with support provided by the college. The requirement for the development of mediated or individualized instructional material is levied by the college on the instructional staff and various incentives (released time, additional salary, etc.) are extended to those staff members whose output exceeds the established minimum standards.

The college includes, on its support staff, the photographic, audio and graphic talents required to assist/support the development process. Coordination and scheduling are informal processes operating on a first-come first-served basis with the production schedule under control of the Graphics department.

COURSEWARE PRODUCTION

The courseware production cycle at the college functions as follows:

a) The instructor generates the narrative materials for a given block of instruction.

b) The narrative materials are reviewed by the Dean and revised as required.

c) The narrative materials are reviewed with the graphics department and the photographer to insure that the instructors requirements for visuals are thoroughly understood.

d) The graphics department and the photographers schedules are paced by the production of graphics. When the graphics are completed, they and proof prints of the photography are submitted to the instructor for review. Depending on the nature of the material being produced, it may also be tried-out on samples of the anticipated student population. Results of this review and try-out cycle are incorporated and the material is ready for final production.

e) The standard instructional package at Mount San Jacinto is a multi-media package consisting of an audio presentation, manually synchronized 35 mm filmstrip, and an associated workbook. The originals for each of these elements are produced by the college staff.

For audio production, the college has a well equipped sound studio equipped with professional quality audio recording and duplication equipment. Audio presentations are recorded as 1/4-inch masters by members of the sound studio staff or the instructor. The school maintains a large-scale duplication capability for both reel-to-reel and cassette tapes to service in-house and sales requirements.

Photographic facilities at the college are tailored to the production of 35 mm slides and filmstrips. All photography, copywork and the production of the filmstrip master is handled by a single individual. The master files for all presentations are a master set of slides kept by the photo department. All film processing, slide and filmstrip duplication is handled by commercial laboratories.

The college teaches courses in print shop operations and is equipped with a very modern reproduction facility; for several reasons, including cost effectiveness, printing of instructional material is performed by the college itself.

MAINTENANCE PHILOSOPHY

Hardware maintenance at the organizational level (bulb replacement, cleaning, alignment, etc.) is performed by the audio-visual technician attached to the library. Intermediate level maintenance is referred to the manufacturer or authorized service representatives.

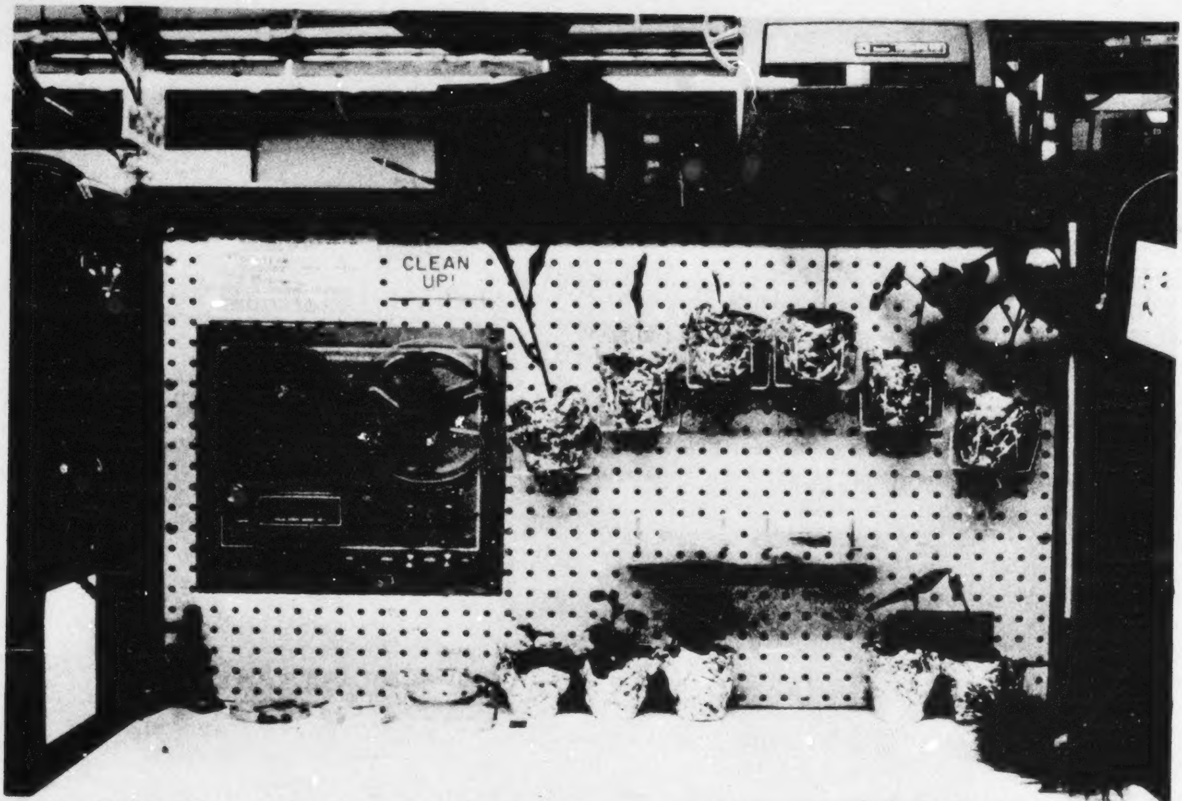
Courseware maintenance and quality control is primarily the function of the library staff and in the outlying study facilities, the instructor. As tapes and/or filmstrip or slide sets become worn they are discarded and replaced from the colleges central stock. Depletion of this stock as a function of student usage or outside sales (a good proportion of the mediated instructional packages developed at Mt. San Jacinto are for sale) is corrected by duplicating another lot of tapes and/or filmstrips.

PURDUE UNIVERSITY
Lafayette, Indiana
(Audio-Tutorial Learning Center)

The Purdue Audio-Tutorial system was begun in 1961 and has evolved slowly to the present learning center configuration. The first programs developed were lectures on tape and relied solely on audio as the medium of communication. This initial effort involved the production of a weekly lecture on audio tape. As the program evolved this was expanded to include tangible items (live plants, models and equipment for experiments), printed materials (textbooks, study guides and journal articles), and visuals (2 x 2 slides, Super 8 mm films and photographs). Ultimately, the program was produced by assembling the appropriate items and, while sitting among these items, recording on audio tape the conversation one would expect to use with one student while tutoring the student through a sequence of learning activities. The product, i.e., the tape and other materials, was then duplicated as many times as necessary to accommodate all students. Because of student enthusiasm for the program the procedure was expanded to cover the content for the entire introductory botany course. The course was then restructured to include three major study sessions:

1) Independent Study Session (ISS) - The audio-tutorial program was placed in a learning center which was open from 7:30 AM to 10:30 PM Monday through Friday. The student could come in at his convenience and check into a carrel. On his way to the carrel he could pick up a mimeographed sheet of objectives written in behavioral terms. Other components needed to complete the program (except for the student's own copy of the textbook and study guide) are housed in the carrel. Materials too bulky or too expensive to include in each carrel are placed on a central table for common use by all students. The student can pace his study as he desires stopping at any point in the program to use additional resources, such as supplemental texts and discussions with the instructor on duty or with peers. Each student proceeded independently of other students and was free to omit any part of the study unnecessary to help him achieve the stated objectives for the week.

2) General Assembly Session (GAS) - This session is scheduled on a weekly basis and included 300 or more students. Activities in this assembly involve an occasional lecture, special films, major exams and other activities that could be done most effectively in a large group. Attendance is required only for certain special events.



Typical AUDIO-TUTORIAL student study carrel configuration.

A view of the Audio–Tutorial Laboratory showing carrels and activity areas

3) Integrated Quiz Session (IQS) - This session involves eight students and an instructor scheduled to meet weekly for 1/2 hours. The primary purpose of the session is to exploit the principle that "one really learns a subject when one is required to teach it". For this session each student was expected to prepare a lecture about each of the items used in the ISS. The instructor presents the items in the sequence programmed earlier and selects the student to lecture on a random basis.

The Audio-Tutorial system in this form has been adopted in a great many schools and in a broad spectrum of disciplines (one-third of the papers presented at the Second Annual Audio-Tutorial Conference held at Purdue in November, 1970 dealt with the subject matter areas outside the field of biology and several were concerned with programs below the college level). In 1969 a zoology course (Biology 109) was converted to the Audio-Tutorial approach. At that time it was decided to reorganize the content of both the zoology and botany courses into smaller units of information called minicourses. Each minicourse would cover a reasonably coherent segment of subject matter (topic) and each minicourse would have a written set of specific objects suitable for testing the student's mastery of the concepts included. No rigid guidelines were established as to length or teaching strategy. Primarily, the limits of a minicourse were determined by good judgment much as one decides how to divide a book into chapters. Approximately 30 minicourses were identified for each course and several of these minicourses covered subjects common to both zoology and botany. It was clear that if students were required to master the objectives in their first study of the common minicourses it would be redundant to involve them with the same subject matter a second time in the subsequent course.

As each student masters the objectives for a particular common minicourse, it is recorded on his individual card and he is not required to repeat the minicourse again. Thus, students entering the two course sequence through either botany or zoology and taking a common minicourse during their first enrollment accumulate some time which can be devoted to the exploration of their own interests through the study of optional minicourses during the second semester of their enrollment. The botany and zoology courses which had previously been two distinct four credit hour courses now represent a "pool" of minicourses divided into four categories:

1) Plant minicourses
2) Animal minicourses
3) Common minicourses
4) Optional minicourses

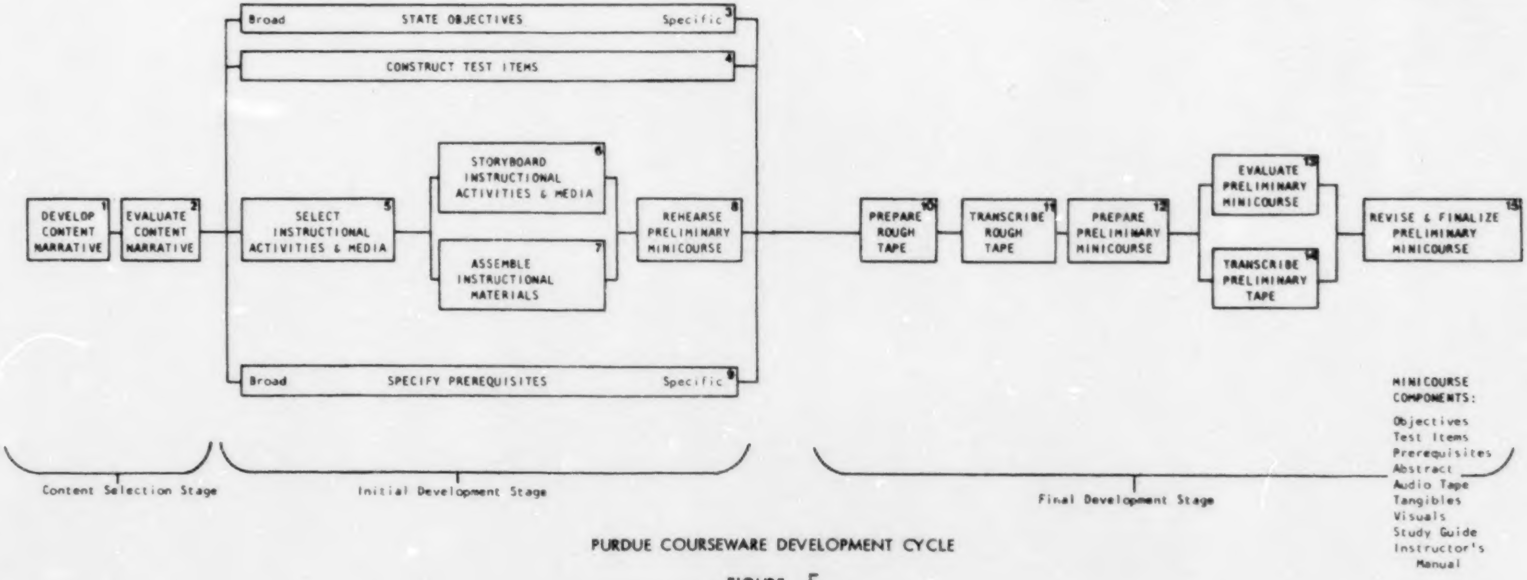
MINICOURSE DEVELOPMENT SEQUENCE

PHASE I

Overview

MINICOURSE DEVELOPMENT SEQUENCE

Phase	I	II	III	IV
Operation	Preliminary Development	Pilot Testing	Field Testing	Publication
Product	Preliminary Version	Trial Version	Test Version	Final Version



DEVELOP CONTENT NARRATIVE 1
EVALUATE CONTENT NARRATIVE 2
Broad STATE OBJECTIVES Specific 3
CONSTRUCT TEST ITEMS 4
SELECT INSTRUCTIONAL ACTIVITIES & MEDIA 5
STORYBOARD INSTRUCTIONAL ACTIVITIES & MEDIA 6
ASSEMBLE INSTRUCTIONAL MATERIALS 7
REHEARSE PRELIMINARY MINICOURSE 8
Broad SPECIFY PREREQUISITES Specific 9
PREPARE ROUGH TAPE 10
TRANSCRIBE ROUGH TAPE 11
PREPARE PRELIMINARY MINICOURSE 12
EVALUATE PRELIMINARY MINICOURSE 13
TRANSCRIBE PRELIMINARY TAPE 14
REVISE & FINALIZE PRELIMINARY MINICOURSE 15
Content Selection Stage
Initial Development Stage
Final Development Stage
MINICOURSE COMPONENTS:
Objectives
Test Items
Prerequisites
Abstract
Audio Tape
Tangibles
Visuals
Study Guide
Instructor's Manual

PURDUE COURSEWARE DEVELOPMENT CYCLE

FIGURE 5

After two years experience Purdue feels that it is possible to combine the Audio-Tutorial system with the concepts of mini-courses and mastery to develop a learning system which provides a great deal more individualization and flexibility than the conventional lecture-laboratory approach.

COURSEWARE DEVELOPMENT

The instructional strategies employed at Purdue include audio-tutorial, independent study, small group discussion and large group assembly. The beginning Biology, Botany and Zoology courses were chosen for the audio-tutorial application primarily because of the large (2, 800) student population in these classes. An estimated 75% of the instructional packages are developed internally by the Learning Center staff. Most of the visuals, including films, are purchased. Tangible items are supplied primarily by the department green house and animal facilities. Some of the specimens used are purchased from the outside.

COURSEWARE PRODUCTION

Responsibility for courseware development belongs to the Senior Professor in charge of the Learning Center, with the assistance of graduate teaching assistants and the production staff of the center. The development/production sequence for a minicourse package is shown in Figure 4-1.

MAINTENANCE PHILOSOPHY

The Senior Professor in charge of the Learning Center, based upon the results of evaluations of the course material effectiveness, determines when instructional material is in need of revision. The required revisions are performed by department assistants, graduate teachers, and the Senior Professor.

Hardware maintenance is performed by a technician on assignment to the center.

UNIVERSITY OF ILLINOIS
Urbana, Illinois
Computer-Based Education Research Laboratory
(PLATO System)

The Computer-based Education Research Laboratory at the University of Illinois has been responsible for design, development and implementation of the PLATO IV instructional system.

The PLATO IV system is now under development by the laboratory. It has the capability to be expanded to 4,000 terminals most of which would be located within an approximate 150-mile radius of Champaign-Urbana. All terminals access a central Control Data Corporation Cyber 73 series computer via telephone lines. PLATO IV uses a plasma display panel in lieu of a CRT. High-speed random access slide and audio devices are available as optional equipment for the terminal. As of January 1974, over 300 terminals had been connected to the system. Classroom operations on PLATO IV were begun in early 1973. The system is being used at the University of Illinois, and at public elementary schools and community colleges in several cities in Illinois. Over 15 remote terminals are in use at various military centers as a result of sponsorship by the Defense Advanced Research Projects Agency (ARPA).

COURSEWARE DEVELOPMENT

Subject areas for which lessons have been developed and are currently available on the PLATO IV system include, arithmetic, geometry, russian, french, latin, chemistry, physics, biology, political science, psychology, and engineering. Lesson materials are prepared by subject matter experts, usually the teacher of the course involved.

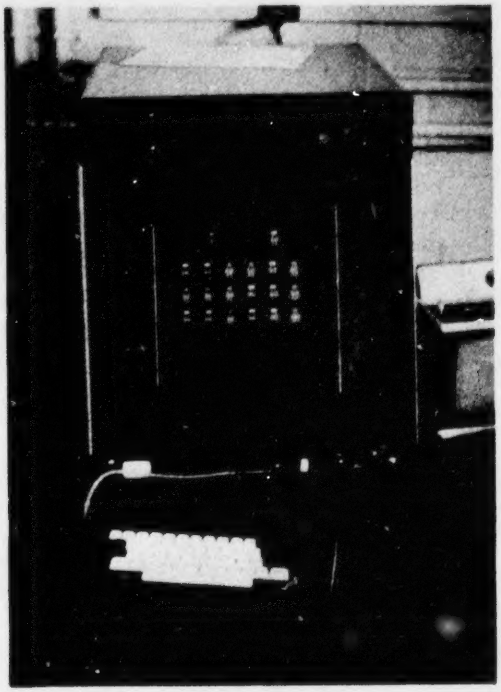
The basic philosophy of the PLATO system is that:

1) The computer should be used only when it is the best method of presentation. Less expensive methods should be used when appropriate.

2) "The interactive nature of this instructional medium typically absorbs the attention and encourages the total involvement of students at all age and grade levels."

3) "The student may proceed at his own pace and can exert considerable choice in the selection of alternative teaching strategies and methods of presentation."

4) "The feedback of information is applied not only in the learning process but also in the teaching process; the system provides teacher or author with the means of assessing in detail the progress of the individual student..."



PLATO IV Display/Keyboard unit with a sample of a study program on genetics displayed.

Students using the PLATO III system.

COURSEWARE PRODUCTION

Although the PLATO software system has become increasingly more sophisticated and permits experienced authors to develop very complex teaching strategies and lessons, it is not necessary for an author to become, or be dependent on, a systems programmer. Experience has shown that teachers and authors can begin to prepare, edit, or modify lesson materials after a few hours of familiarization with the TUTOR language, without previous experience.

Lesson materials may be written or edited at a student console at any location while other consoles are being used by the students. In addition, materials previously prepared elsewhere may be modified by a teacher/author to meet the particular needs of his own students.

MAINTENANCE PHILOSOPHY

All lesson materials revisions and modifications are the responsibility of the individual teacher/author. PLATO equipments are maintained by the appropriate Research Laboratory or contractor personnel.